WHAT WORKS IN DISTANCE LEARNING

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EXECUTIVE SUMMARY

The purpose of this report is to document our progress to date in what works in distance learning (DL). This research is being conducted by the University of Southern California (USC) via a subcontract with UCLA/CRESST. UCLA/CRESST was funded by the Office of Naval Research (ONR) to conduct research in "Knowledge, Models and Tools to Improve the Effectiveness of Naval Distance Learning." An overriding goal of this effort is to create a robust and clear set of design guidelines to support the next generation of DL training. There are five critical dimensions of the DL system we propose to support with guideline references: management strategies, learner characteristics (including individual differences, learning and motivational strategies), instructional strategies, multimedia strategies, and assessment strategies.

The basic methodology was to conduct a research synthesis by experts, using analytical methods, on what is known about what works in distance learning. Research in the literature was reviewed for design flaws, and only studies with robust designs were included. Also, we included only those entries for which research evidence and expert opinion were stable and consistent. Further, we decided that this information would be provided to researchers, instructors, program managers, and instructional or assessment designers in a "What Works" format, that is, *What Works in Distance Learning*. We adopted many of the conventions of *What Works: Research About Teaching and Learning* (U.S. Department of Education, 1986, 1987).

There are two types of documentation provided for this *What Works* effort. The first is this technical report, which documents the rationale and approach, provides the guidelines, and addresses implementation issues. This report is targeted mainly towards the research and program management communities. The second type of documentation is a set of "books" that are organized by guideline area (e.g., "What Works in Distance Learning: Instructional Strategies"). These books include a brief introduction, the guidelines for the area, all of the cited references, and an appendix, which is this report. It was intended that the books would be stand-alone and self-contained documents. The audience for the books is the program manager or instructional or assessment designer in the Navy.

CHAPTER 1
BACKGROUND AND PURPOSE

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The purpose of this report is to document our progress to date in what works in distance learning. This research is being conducted by the University of Southern California (USC) via a subcontract with UCLA/CRESST. UCLA/CRESST was funded by the Office of Naval Research (ONR) to conduct research in "Knowledge, Models and Tools to Improve the Effectiveness of Naval Distance Learning."

The overall goals of this CRESST effort are to apply the best scientific knowledge to improving the effectiveness of Navy and Marine distance learning applications through the tools used to make design and delivery choices, and to successfully transition end results to operational training environments in Naval Forces and the Marine Corps. The specific objectives of this effort are (1) to develop guidelines for the design of distance learning courses based on an analysis of experience and research on learning, instruction, and assessment; (2) to test the guidelines through research based on their application to developing and evaluating components of distance learning courses; (3) to transition guidelines, tools, and technologies to Navy and Marine Corps operational training environments. This report discusses progress on Objective 1 in Year 1 of our subcontract. The remaining objectives will be reported in a later document.

A considerable challenge exists in integrating knowledge from diverse sources into a set of comprehensive, coherent, and useful distance learning (DL) guidelines and applying those guidelines to the development and application of distance learning components. An overriding goal of this effort is to create a robust and clear set of design guidelines to support the next generation of DL training. There are five critical dimensions of the DL system we propose to support with guideline references; that is, management strategies, learner characteristics (including individual differences, learning and motivational strategies), instructional strategies, multimedia strategies, and assessment strategies.

These strategies come from our analysis of competing instructional models historically used in training and education. By analyzing the strengths and weaknesses of each model, we were able to indicate which of its attributes should be moved forward as candidate elements for a new set of design principles to support distance learning. Following this analysis, we provided a top-level view of the attributes of an instructional model. Among the archetypal models containing elements from which the new instructional model could be constructed are the following: gifted teacher/mentor, instructional systems development, computer-assisted instruction/embedded systems, and intelligent tutoring systems.

The gifted teacher/mentor model has the longest and most revered tradition in teaching and learning, and at its best, involves teacher/mentors that possess deep content understanding, high pedagogical knowledge, insight into the needs of particular students, and the ability to encourage and motivate. What these mentors do is personal and unique, however; it cannot be easily replicated or scaled up. The instructional systems development model, on the other hand, provides guidelines for systematizing and scaling up instructional delivery. At its best, the instructional systems development model produces rules that are empirically derived and uses

the extant research base in psychology and learning as a source of recommendations on methods such as advance organizers, practice, feedback, and sequencing. Instructional systems development's limitation, however, is that it has tended to become overly routinized, orthodox, and rigid, leading to rules that are arbitrary and inadequately reflective of contemporary research. The computer-assisted instruction/embedded systems model represents an attempt to apply some aspects of the instructional systems development model in advanced technology settings, including full- and part-task simulations. Much of computer-assisted instruction, however, has not taken advantage of recent research on learning and assessment, and computer-assisted instruction often exemplifies a routinized "ask-present-ask-present-ask" sequence that is unlikely to sustain high interest over time. Finally, intelligent tutoring systems components have been used in various systems, ranging from adaptive individual tutors to the use of natural language to understand student responses or messages. Intelligent tutoring systems approaches have raised the salience of detailed analyses of content and skills to be learned, focused on the ideal attributes of adaptive instruction, and highlighted the role that compiled expertise can play in the design and operation of a variety of systems. At present, the limitation of intelligent tutoring systems relates to scalability. Domains of interest in intelligent tutoring systems tend to be very narrow, and large-scale development of intelligent tutoring systems is inhibited by cost, technology demands, and expertise.

Nevertheless, our analysis of instructional efforts, supported both within and outside the Navy, illustrates that each of the four archetypes has elements or features that are desirable and can begin to define the design space for DL guidelines. From the gifted teacher/mentor archetype, we identify the importance of motivational and social supports designed to support and sustain learners' commitment to education. From instructional systems development we

identify the importance of deriving clear instructional strategies and assessments and attending to the notion of flexible scalability of future systems. From the computer-assisted instruction/embedded systems model, we extrapolate the importance of learning in context and the role of learning strategies for adult learners. From intelligent tutoring systems models we bring the importance of adaptation based on student needs, the importance of domain specification, and the importance of mapping cognitive demands appropriately to task design. From extant research on these models, then, we extracted one or more useful guidelines for specifying the critical dimensions of the distance learning instructional and assessment system.

A technical report of findings was generated (this report) and includes the distance learning guidelines. The online implementation of the guidelines and conclusions about their efficacy will be documented in a later report. The guidelines will be disseminated to the research community via conferences (e.g., O'Neil, 2003) and other publications (e.g., a possible book).

Specific Methodology

The basic problem addressed is that research-based guidelines are needed to help Naval and contractor personnel design, evaluate, and use distance learning. Further, these guidelines must be accessible and useful. The basic methodology was to conduct a research synthesis by experts, using analytical methods, on what is known about what works in distance learning. Research in the literature was reviewed for design flaws, and only studies with robust designs were included. Also, we included only those entries for which research evidence and expert opinion were stable and consistent. Further, we decided that this information would be provided to researchers, instructors, program managers, and instructional or assessment designers in a "What Works" format, that is, *What Works in Distance Learning*. We adopted many of the conventions of *What Works: Research about Teaching and Learning* (U.S. Department of

Education, 1986, 1987). Our goal for non-researchers was to translate the research findings into clear and comprehensible statements that we think can help users to guide their practice. For both researchers and non-researchers, the references cited for each finding provide an avenue to seek additional information.

Our format conventions (see Figure 1) are modified from the format conventions of *What Works: Summary of Research Findings With Implementations for Navy Instruction and Learning* (Montague, 1988). The following format conventions are quoted from that document. The report will "be organized into sections presenting the research synopses. Each gives a short statement presenting the research findings of practical value for the user group. A comment section explains more about the findings and how one might implement conditions that should lead to similar results. References are included for readers who might be interested in the evidence supporting the finding or, in some cases, describing detailed procedures for implementation" (Montague, 1988, p.□). These format constraints are the same as those in *What Works: Research About Teaching and Learning* (U.S. Department of Education, 1987). Our modification for the guidelines format consisted of adding (a) a brief section specifying whether a guideline was based on research or expert opinion, (b) a brief rating of the degree of our confidence in the guideline (high, medium, or low), (c) a glossary of terms used, and (d) an indication of the role(s) of the primary users to whom the guideline is addressed.

Table 1 shows some existing, but dated, guideline reports that use a "What Works" format.

Table 1

Prior *What Works* Documents

What Works: Research About Teaching and Learning
U.S. Department of Education. (1987). *What works: Research about teaching and learning* (2nd ed., IS 87-110). Washington DC: U.S. Government Printing Office.
Summary of Research Findings With Implications for Navy Instructions and Learning
Montague, W. E. (Ed.). (1988). *What works: Summary of research findings with implications for Navy instruction and learning* (NAVEDTRA 115-1). Pensacola, FL: Office of the Chief of Naval Education and Training.
What Works in Adult Instruction
Montague, W. E., & Knirk, F. G. (1993). *What works in adult instruction: The management, design and delivery of instruction* (NPRDC TR 93-6). San Diego, CA: Navy Personnel Research and Development Center.
What Works in Alternative Assessment
Baker, E. L., O'Neil H. F., Jr., & Linn, R. L. (1992, September). *What works in alternative assessment?* Sherman Oaks, CA: Advance Design Information, Inc.

Our guidelines production strategy involved the following steps: (a) Use experts to compile knowledge; (b) use a standardized format for the guidelines, which requires a scientific base; (c) create a paper version; (d) transition to Navy Education and Training Command (NETC).

Our guidelines specifications that the experts used to generate the distance learning guidelines are shown in Figure 1.

Title of Guideline[1,2]	
Section	Definition/Function
1. Guideline (non-technical):	One-sentence overview of findings. What would you tell a smart but not technically oriented significant other about the area? e.g., "In remedial instruction feedback under learner control depends on prerequisite knowledge as well as motivation."
2. Guideline (technical):	A one-sentence description of findings in technical terms (ideally expressed as an if-then rule); e.g., in the area of an instructional strategy for learner control: "If the student fails, and the degree of learning required is high, and student motivation and prerequisite knowledge are high, then the instructional strategy recommended is learner control for remedial instruction; otherwise, use the instructional strategy of system control."
3. Guideline based on:	Research or expert opinion.
4. Degree of confidence:	Your degree of confidence in the guideline. Low, medium, high (if no empirical evidence, the high-confidence category cannot be used).
5. Comments:	Two to three paragraphs about the findings. Could include more detail and ways to implement the guideline to lead to similar findings. Best evidence would be empirical.
6. References:	Three to four, APA style (provide the paper copy/soft copy of the actual references). These are provided for users who want more detail. One of the references should be seminal (defined area or key terms, scholar that represents area, etc.). One reference should be to a literature review in the area. A meta-analysis would give the best evidence. The remaining references should be to recent journal articles (or to sources someone could easily find, e.g., no conference presentations, dissertations, technical reports, etc.).
7. Glossary:	One-sentence definitions (with paper copy/soft copy of reference) of all jargon on the page.
8. User:	For whom did you write the guideline? e.g., instructional designer or program manager?

[1]Design Specifications: ONR DL Guidelines (Maximum 2 pages, single-spaced).

[2]Include version number, date, and page numbers in document header.

Figure 1. Draft 6, ONR guideline specifications.

In preparing this document, it became clear that some sort of identification label was needed for the individual guidelines, as they might be accessed through a Web site. Thus, as may be seen in Figure 2, a ninth category was added—ID. The ID consists of the author name(s), title of *What Works,* the area addressed by the set of guidelines, the title of the specific guideline, a version number (for configuration control), and the date of most recent revision (update). This date would serve also to alert a reader of the guidelines as to whether the information was current.

Title of Guideline[1,2]	
Section	Definition/Function
1. Guideline (nontechnical):	One-sentence overview of findings. What would you tell a smart but not technically oriented significant other about the area? e.g., "In remedial instruction feedback under learner control depends on prerequisite knowledge as well as motivation."
2. Guideline (technical):	A one-sentence description of findings in technical terms (ideally expressed as an if-then rule); e.g., in the area of an instructional strategy for learner control: "If the student fails, and the degree of learning required is high, and student motivation and prerequisite knowledge are high, then the instructional strategy recommended is learner control for remedial instruction; otherwise, use the instructional strategy of system control."
3. Guideline based on:	Research or expert opinion.
4. Degree of confidence:	Your degree of confidence in the guideline. Low, medium, high (if no empirical evidence, the high-confidence category cannot be used).
5. Comments:	Two to three paragraphs about the findings. Could include more detail and ways to implement the guideline to lead to similar findings. Best evidence would be empirical.
6. References:	Three to four, APA style (provide the paper copy/soft copy of the actual references). These are provided for users who

	want more detail. One of the references should be seminal (defined area or key terms, scholar that represents area, etc.). One reference should be to a literature review in the area. A meta-analysis would give the best evidence. The remaining references should be to recent journal articles (or to sources someone could easily find, e.g., no conference presentations, dissertations, technical reports, etc.).
7. Glossary:	One-sentence definitions (with paper copy/soft copy of reference) of all jargon on the page.
8. User:	For whom did you write the guideline? e.g., instructional designer or program manager?
9. ID:	Author name, *What Works in Distance Learning: [Key Area],* title of guideline, version #, day, month and year of most recent update.

[1]Design Specifications: ONR DL Guidelines (Maximum 2 pages, single-spaced).
[2]Include version number, date, and page numbers in document header.

Figure 2. Revised ONR guideline specifications.

We developed the following core set of research-based distance learning guidelines for five key areas: (a) Instructional Design, by Dr. Richard Clark; (b) Multimedia, by Dr. Richard Mayer; (c) Learning Strategies, by Dr. Myron Dembo and Ms. Linda Gubler Junge; (d) Assessment Strategies, by Dr. Eva Baker, Dr. Zenaida Aguirre-Muñoz, Ms. Jia Wang and Dr. David Niemi; and (e) Management Strategies, by Dr. Edward Kazlauskas. Each set was edited by Dr. Harry O'Neil and revised by the author(s). Then each set was copyedited and reviewed and approved by the author(s). The order of the sets of guidelines is arbitrary.

The remaining chapters in this report provide the 2-page guidelines for each of the five areas and a discussion of implementation issues.

CHAPTER 2

WHAT WORKS IN DISTANCE LEARNING: INSTRUCTIONAL STRATEGIES

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The following guidelines are presented in this chapter.

1. Strategies Based on Providing Learner Control of Instructional Navigation
2. Strategies Based on Providing Worked Examples and Practice
3. Strategies Based on Effective Feedback During Learning
4. Strategies Based on Increasing Student Motivation: Encouraging Active Engagement and Persistence
5. Strategies Based on Increasing Student Motivation: Helping Learners Invest Maximum Mental Effort
6. Strategies Based on Teaching Concepts
7. Strategies Based on Teaching Process Knowledge
8. Strategies Based on Teaching Causal Principles
9. Strategies Based on Teaching Procedural (How to) Knowledge

Strategies Based on Providing Learner Control of Instructional Navigation
(Clark, v.5, 02/03/03)

1. Guideline (nontechnical):	As the extent of learner control increases, learning decreases except for a very small number of the most advanced expert learners.
2. Guideline (technical):	When distance learning courses direct the sequencing, contingencies, and learning strategies during instruction and permit only minimal learner control over pacing, then, except for the most advanced expert learners, learning will be increased.
3. Guideline based on:	Research
4. Degree of confidence:	High
5. Comments:	The high levels of learner control afforded by distance learning media and contexts are often described as one of the potential advantages of distance learning (Hannafin & Sullivan, 1995). Yet the evidence from a great variety of studies examining different learners, learning tasks, and settings suggests that as the extent of learner control over various aspects of instruction increases, learning may decrease. This seems to be the case even when learners are assigned to their preferred level of control over instructional presentations (Niemiec, Sikorski, & Walberg, 1996). While it is possible to find studies that provide evidence for the benefits of some limited forms of learner control, such as control over the pacing of a presentation (Doherty, 1998), it is likely that more extensive control aids only the learning of students with very high levels of prior knowledge of the subject matter and/or those who have learned how to benefit from increased control. A comprehensive review and meta-analysis of many learner control studies by Niemiec et al. (1996) reported an overall negative impact. This negative impact extends to studies where learners were allowed to select the amount of control they exercised over their course (Hannifin & Sullivan, 1995). While system control of instructional events and strategies may not be helpful to more advanced students, it apparently does not harm them (Hannifin & Sullivan, 1995). Thus it does not appear to be harmful to provide system control of instruction to even more advanced learners.
6. References:	Doherty, P. D. (1998, October). Learner control in asynchronous learning environments. *ALN Magazine, 2*(2). Retrieved December 4, 2002, from http://www.aln.org/alnweb/magazine/vol2_issue2/doherty.htm#1-7

Hannafin, R. D., & Sullivan, H. D. (1995). Learner control in full and lean CAI programs. *Educational Technology Research & Development, 43*(3), 19-30.

Niemiec, R. P., Sikorski, C., & Walberg, H. J. (1996). Learner-control effects: A review of reviews and a meta-analysis. *Journal of Educational Computing Research, 15*, 157-174.

7. Glossary:

Contingencies: Decision rules that guide instructional presentations based on learner performance within a course. So, for example, if a learner enters a wrong answer for a practice test item, a system contingency might be to direct the student to review relevant sections of the lesson and then repeat the practice.

Instructional strategies: Methods of organizing, sequencing, and presenting instruction that increase both student learning and the transfer of their learning to application contexts.

Learner control: The degree to which a distance learning course permits individual students to control the path, pace, and/or contingencies of instruction.

Learning strategies: The techniques or methods students use to learn or acquire new information.

Pacing: The speed with which a course presents information to students.

Sequencing: The order in which information, lessons, and learning tasks are presented to students within a course.

8. User: Instructional designers and developers

9. ID: Richard Clark, *What Works in Distance Learning: Instructional Strategies,* Strategies Based on Providing Learner Control of Instructional Navigation, v.5, updated last on 02/03/03. See also O'Neil, H. F. (2003). *What works in distance learning* (Report to the Office of Naval Research). Los Angeles: University of Southern California, Rossier School of Education. Available at [URL to be added]

Strategies Based on Providing Worked Examples and Practice
(Clark, v.5, 02/03/03)

1. Guideline (nontechnical):	When instruction provides clear (to the learner) and complete procedural "how to" examples of the decisions and actions needed to solve problems and perform necessary tasks to be learned, then learning and transfer will be increased.
2. Guideline (technical):	The more complete and accurate the worked examples presented during instruction (with accompanying conceptual explanations of why different elements of the procedure "work" to achieve a performance goal), the more that learning is accomplished quickly and accurately, and the more effectively learning transfers to work performance. These worked examples should result from a cognitive task analysis.
3. Guidelines based on:	Research
4. Degree of confidence:	High
5. Comments:	Experiments comparing worked examples with conceptual instruction and problem-based discovery learning (Kalyuga, Chandler, Touvinen, & Sweller, 2001; Touvinen & Sweller, 1999) found clear evidence that worked examples were superior and enhanced not only learning but transfer of learning outside of the training setting. Touvinen and Sweller (1999) and Kalyuga et al., (2001) also found that the benefit of worked examples decreased and the benefit of problem solving increased as learners became more expert. van Merrienboer (1997) strongly suggested that the use of worked examples to solve task-relevant problems should be an essential component of all practice during instruction. Touvinen and Sweller (1999) demonstrated that when properly designed, worked examples are superior to discovery learning for all but the most advanced learners, and that even advanced experts get equal benefit from discovery learning and worked examples and so seem not to be harmed by examples. However, Kalyuga, Chandler, and Sweller (2001) found that experts benefited more from solving problems than from worked examples. van Merrienboer, Clark, and de Croock (2002) provided an example of a worked example for teaching Web-based information search.
6. References:	Kalyuga, S., Chandler, P., Touvinen, J., & Sweller, J. (2001). When problem solving is superior to worked examples. *Journal of Educational Psychology, 93,* 579-588.

Touvinen, J. E., & Sweller, J. (1999). A comparison of cognitive load associated with discovery learning and worked examples. *Journal of Educational Psychology, 91,* 334-341.

van Merrienboer, J. J. G., Clark, R. E., & de Croock, B. M. (2002). Blueprints for complex learning: The 4C/ID-model. *Educational Technology Research and Development, 50*(2), 39-64.

7. Glossary:

Cognitive task analysis: A method of analyzing procedures in which an interviewer collects from experts a temporal order of overt actions and mental (covert) decisions (solutions) required to achieve a goal state from a given state (problem or current conditions).

Given state: The description of an existing problem or current "condition" that must be changed in order to achieve a "goal state" or objective.

Goal state: The desired end-result or objective of the performance being learned.

Procedure: A sequenced list of overt actions and covert decisions (with the criteria or rules for selecting alternatives as decisions are being made) that enables the learner to transform a given state to a goal state.

8. User: Instructional designer

9. ID: Richard Clark, *What Works in Distance Learning: Instructional Strategies,* Strategies Based on Providing Worked Examples and Practice, v.5, updated last on 02/03/03. See also O'Neil, H. F. (2003). *What works in distance learning* (Report to the Office of Naval Research). Los Angeles: University of Southern California, Rossier School of Education. Available at [URL to be added]

Strategies Based on Effective Feedback During Learning
(Clark, v.5, 02/03/03)

1. Guideline (nontechnical): Effective feedback about learning progress results in better learning and transfer of such learning to the work environment.

2. Guideline (technical): The more that learning and performance feedback (a) is based on concrete learning goals that are clearly understood by students, (b) describes the gap between the student's learning goal and the student's current performance and suggests how to close that gap, and (c) focuses the student's attention on the learning goal and not on his/her failure to achieve the goal, the more effective it becomes for learners, learning, and transfer of learning to performance settings.

3. Guidelines based on: Research

4. Degree of confidence: High

5. Comments: Feedback during learning has been examined for many years by many different researchers with very mixed and often conflicting results (Kluger & DiNisi, 1998). Recent attempts to resolve these disagreements have begun to pay off. For example, a recent international review of well-designed performance feedback research studies (Kluger & DiNisi, 1998) produced a surprising insight. Performance feedback actually depressed performance in one third of all feedback research studies conducted both in natural settings and in the laboratory. In another third of the studies, performance feedback had no impact. In only one third of the studies did feedback increase performance.

Learning problems appear to be caused by feedback that is not focused on clear performance goals and current performance results. Effective performance feedback must be focused on closing the gap between a student's learning goals and the student's current progress. Feedback is effective only when learning goals are clearly understood by students. When feedback emphasizes the performer by pointing out poor performance or a lack of performance, or when it suggests that the performer is being made responsible for goals that were not made clear initially, performance most often deteriorates. Kluger and DiNisi (1998) also emphasized that when adults feel that their learning will be directly transferable to their work and when their work performance is connected to their personal growth, performance feedback is most beneficial. The finding that poor feedback was obvious in two thirds of all well-planned research studies suggests

that it may be even more prevalent in practice since researchers tend to select what are thought to be the best strategies to test in experiments.

It is doubtful that any feedback strategy will work equally well for all learners or that a strategy that conforms to the suggestions made by Kluger and DiNisi (1998) will succeed for everyone. There is some evidence, for example, that learners who are motivated to "look good" but who do not value learning what is being taught will not benefit from feedback, and there is also evidence that when learning tasks are easy to achieve, pointing out mistakes and attributing them to the learner may be helpful (Wofford & Goodwin, 1990).

6. References:

Kluger, A., & DiNisi, A. (1998). Feedback interventions: Toward the understanding of a double-edged sword. *Current Directions in Psychological Science*, *7*(3), 67-72.

Wofford, J. C., & Goodwin, V. L. (1990). Effects of feedback on cognitive processing and choice of decision style. *Journal of Applied Psychology, 75,* 603-612.

7. Glossary: None

8. User: Instructional designer

9. ID: Richard Clark, *What Works in Distance Learning: Instructional Strategies,* Strategies Based on Effective Feedback During Learning, v.5, updated last on 02/03/03. See also O'Neil, H. F. (2003). *What works in distance learning* (Report to the Office of Naval Research). Los Angeles: University of Southern California, Rossier School of Education. Available at [URL to be added]

Strategies Based on Increasing Student Motivation:
Encouraging Active Engagement and Persistence
(Clark, v.5, 02/03/03)

1. Guideline (nontechnical): Designers can help students to become actively engaged in a course or lesson and to persist or stay "on track" when distracted by helping students connect their personal goals and interests to course goals, by clearly communicating the utility of the course goals (and the risk of not achieving them), and by helping students maintain their confidence in achieving the course goals (by pointing out past successes with similar goals).

2. Guideline (technical): The more that instruction supports student interest and utility value for course goals and student self-efficacy for the course by convincing students that they are capable of achieving the learning and performance goals of the course, the more they will become actively engaged in the course and persist when environmental events distract them.

3. Guidelines based on: Research

4. Degree of confidence: Moderate to high

5. Comments: Clark (1999) suggested that there are three "indexes" or types of motivational goals for instruction: (a) active engagement or choice (learners actively start to do something that they formerly "intended" to do but had not started); (b) persistence (learners continue to work towards a learning or performance goal in a focused way, despite distractions); and (c) mental effort (defined as the number of non-automatic elaborations invested in learning). Evidence from a number of studies supports the generalization that active engagement and persistence in distance courses is increased by two factors—value and self-efficacy. When learners personally value what they are learning, they choose to get involved and persist over time. Active choice and persistence are also enhanced by students' beliefs that they have the ability or efficacy to learn and apply what is being taught on the job. Values include both their interest in the course objectives and the utility they associate with the benefits of finishing the course (Kanfer & McCombs, 2000).

There are suggestive indicators in existing Web-based case studies about what features students value in courses and which of those features are often missing in Web-based instruction. For example, many prospective distance-learning students may be trying to overcome their perceived lack of personal contact with instructors

in classroom-based courses. Students at the State University of New York who reported the highest levels of instructor interaction also reported the highest levels of value for the course (Fredericksen, Pickett, Shea, Pelz, & Swan, 2000). Thus, it seems clear that motivating distance instruction must emphasize instructor-student contact, and that this increased interaction may enhance the value of the course and therefore increase student active choice and persistence.

6. References:

Clark, R. E. (1999). The CaNE (Commitment and Necessary Effort) model of work motivation: A two-stage process of goal commitment and mental effort. In J. Lowyck (Ed.), *Trends in corporate training*. Leuven, Belgium: University of Leuven Press.

Fredericksen, E., Pickett, A., Shea, P., Pelz, W., & Swan, K. (2000). Student satisfaction and perceived learning with on-line courses: Principles and examples from the SUNY learning network. *Journal of Asynchronous Learner Networks, 4*(2). Retrieved June 30, 2002, from http://www.aln.org/alnweb/journal/Vol4_issue2/le/Fredericksen/LE-fredericksen.htm

Kanfer, R., & McCombs, B. L. (2000). Motivation: Applying current theory to critical issues in training. In S. Tobias & J. D. Fletcher (Eds.) *Training and retraining: A handbook for business, industry, government and the military* (pp. 85-108). Woodbridge CT: Macmillan Reference USA.

7. Glossary: None

8. User: Instructional designer, instructor

9. ID: Richard Clark, *What Works in Distance Learning: Instructional Strategies,* Strategies Based on Increasing Student Motivation: Encouraging Active Engagement and Persistence*,* v.5, updated last on 02/03/03. See also O'Neil, H. F. (2003). *What works in distance learning* (Report to the Office of Naval Research). Los Angeles: University of Southern California, Rossier School of Education. Available at [URL to be added]

Strategies Based on Increasing Student Motivation:
Helping Learners Invest Maximum Mental Effort
(Clark, v.5, 02/03/03)

1. Guideline (nontechnical): The more that learners are convinced that the important elements of a learning task are novel to them, the more mental effort they will invest to succeed. Conversely, the more that students believe that a learning task is familiar, the more overconfident they become, the less mental effort they invest to learn, and the less they are inclined to accept responsibility for failure to learn.

2. Guideline (technical): To help students invest more deliberate, "mindful" mental effort to achieve learning and performance goals, instructional messages should point out the novel elements of what students are learning and emphasize the need to "work hard," provide very concrete and challenging but achievable learning and performance goals, and keep the cognitive load in instructional presentations at a minimum by focusing on only new and important information so that students are not overloaded with information.

3. Guidelines based on: Research

4. Degree of confidence: Moderate to high

5. Comments: Do not be misled by claims that distance learning is, by itself, motivating to students. The evidence for this claim has not been forthcoming from many studies. Salomon (1984) presented compelling contrary evidence that students who expressed a preference for learning from instruction presented via new media tended to expect that they would have to invest less effort to learn. He argued that this expectation of "easier learning" results in the investment of lower levels of mental effort by students. He provided evidence of lower achievement levels from instructional conditions that are perceived as less demanding. This finding has been replicated a number of times with different media (see, for example, the discussion of related studies in Clark, 1999).

Clark (1999), following earlier work, suggested that there are three "indexes" or types of motivational goals for instruction: (a) active choice or commitment (learners actively start to do something that they formerly "intended" to do but had not started); (b) persistence (learners continue to work towards a learning or performance goal in a focused way, despite distractions); and (c) mental effort, defined by Salomon (1984) as "the number of non-automatic elaborations invested in learning" (p. 647). Each of these types of

motivational "indicators" may play a different role in, or relate differently to, the learning process in distance education.

Not much is known about the direct impact of online instructional formats on mental effort (aside from Salomon's 1984 cautions), but the early research is not promising. Recent studies (described by Clark, 1999) indicated that many instructional strategies and complex screen displays risk overloading working memory and causing "automated" cognitive defaults where mental effort is both reduced and directed to nonlearning goals. In general, it seems that mental effort may be influenced in large part by the amount of perceived difficulty in a Web-based course. It is possible that when moderately challenging learning goals and tasks are presented, mental effort increases. When learning tasks are too easy or impossibly difficult, mental effort decreases radically. Students seem to be able to accurately report the amount of mental effort they are investing in easy and moderately difficult tasks. Yet there is disturbing evidence that they seem unaware that they stop investing mental effort as learning tasks become extremely difficult or impossible. Designers must exercise caution not to overwhelm Web students with extremely complex tasks or screen design features that overload working memory. Meanwhile, researchers should continue to study how specific tasks and design features impact mental effort.

6. References:

Clark, R. E. (1999). The CaNE (Commitment and Necessary Effort) model of work motivation: A two-stage process of goal commitment and mental effort. In J. Lowyck (Ed.), *Trends in corporate training*. Leuven, Belgium: University of Leuven Press.

Salomon, G. (1984). Television is "easy" and print is "tough": The differential investment of mental effort in learning as a function of perceptions and attributions. *Journal of Educational Psychology, 76,* 647-658.

7. Glossary: None

8. User: Instructional designer, instructor

9. ID: Richard Clark, *What Works in Distance Learning: Instructional Strategies,* Strategies Based on Increasing Student Motivation: Helping Learners Invest Maximum Mental Effort, v.5, updated last on 02/03/03. See also O'Neil, H. F. (2003). *What works in distance learning* (Report to the Office of Naval Research). Los Angeles: University of Southern California, Rossier School of Education. Available at [URL to be added]

Strategies Based on Teaching Concepts

(Clark, v.5, 02/03/03)

1. Guideline (nontechnical):	New concepts should be taught by providing a definition of the concept, examples from the work environment, and practice exercises in which learners are asked to correctly classify many different work-relevant concept examples. If new concepts are presented with these supports, learning of concepts is enhanced. If highly novel applications of the concept are required, then provide practice on many different novel examples of the concept.
2. Guideline (technical):	The more that instruction provides a definition of a concept (a rule), a prototypic example, and classification exercises in practice and tests, the more that near transfer (contextualized) of new concepts will be achieved. The more that novel and varied examples of new concepts are practiced during instruction, the more that far transfer (decontextualized) will be achieved.
3. Guidelines based on:	Research
4. Degree of confidence:	High
5. Comments:	Concepts are any unit of knowledge that has a definition and at least one example. Learners often must learn a great variety of concepts to support accurate classification of events and objects in their work environment. When designing instruction for concepts, it is vital to begin by developing an accurate definition that contains a complete list of only the defining attributes or features of the concept. In addition, instruction must provide work-related examples and practice exercises in which learners are asked to classify a number of new examples of the concepts being learned. This type of instruction results in learning that should transfer to the work environment (Howard, 2000). If transfer is required to very novel applications beyond the current work environment (far transfer), then in addition to practice classifying work-related examples, instructional designers should also include a variety of novel examples of each concept. The more that learners practice classifying varied and novel examples, the higher the probability that they will be able classify very novel new examples in a variety of contexts (Howard, 2000).
6. References:	Howard, R. W. (2000). Generalization and transfer: An interrelation of paradigms and a taxonomy of knowledge extension processes. *Review of General Psychology, 4,* 211-237.

Merrill, M. D. (1983). Component display theory. In C. M. Reigeluth (Ed.), *Instructional design theories and models: An overview of their current status* (pp. 279-333). Hillsdale, NJ: Erlbaum.

Merrill, M. D., & Tennyson, R. D. (1977). *Teaching concepts: An instructional design guide*. Englewood Cliffs, NJ: Educational Technology Publications.

7. Glossary:

Concepts: Any unit of knowledge that has a definition and at least one example.

Far transfer: Knowledge is generalized from the context and examples where it was originally learned and is applied to contexts and examples that are extraordinarily different from the original learning context.

Near transfer: Knowledge is generalized from the context and examples where it was originally learned and is applied to contexts and examples that exist in a work environment that is similar to the one emphasized during learning.

8. User: Instructional designer

9. ID: Richard Clark, *What Works in Distance Learning: Instructional Strategies,* Strategies Based on Teaching Concepts, v.5, updated last on 02/03/03. See also O'Neil, H. F. (2003). *What works in distance learning* (Report to the Office of Naval Research). Los Angeles: University of Southern California, Rossier School of Education. Available at [URL to be added]

Strategies Based on Teaching Process Knowledge
(Clark, v.5, 02/03/03)

1. Guideline (nontechnical):	When designing instruction for a process (how something works), give students a clear narrative description integrated with a visual model of the sequence of events that characterize the process, and describe each stage in the process and what key events or actions occur at each stage to produce a change that leads to the next stage.
2. Guideline (technical):	When teaching about a process (how something works), the more that the instruction provides a visual model with an integrated verbal (narrated) description for the student that states the sequence of events in the process and explains the actions that occur at each stage to change the properties of that stage and so lead to the next stage (the consequences of that change), the greater the learning and transfer of the process.
3. Guidelines based on:	Research
4. Degree of confidence:	High
5. Comments:	Learning about processes requires that a student be able to accurately describe each stage in the process, the actions that occur at each stage, and how the consequences of each action lead to the next stage. Designers often confuse processes (how something works) with procedures (how someone does something). Visual models of the process accompanied by a fully integrated narrative of events that occur at each stage and how they lead to the next stage help students remember both the sequence of stages and the events that occur at each stage. Process knowledge helps learners develop a mental model of an important series of related events in a work setting. Processes can, for example, describe human activities (how a team functions, or should function, to achieve a task), biological events (photosynthesis), or mechanical systems (how the expended shell rejection mechanism works on a weapon). It is important to remember that learning about a process will not ensure that learners will be able to use the process to, for example, make accurate predictions or engage in troubleshooting. Both prediction (what if . . .) and troubleshooting (here is a problem with the system . . . fix it) require procedural knowledge, worked examples, and a great deal of practice (learn by doing).
6. References:	Merrill, M. D. (1983). Component display theory. In C. M. Reigeluth (Ed.), *Instructional design theories and models: An*

overview of their current status (pp. 279-333). Hillsdale, NJ: Erlbaum.

Merrill, M. D. (2000). Knowledge objects and mental models. In D. Wiley (Ed.), *The instructional use of learning objects*. Bloomington, IN: AIT/AECT. Retrieved October 17, 2002, from http://www.reusability.org/read/chapters/merrill.doc

7. Glossary:	*Process knowledge*: "Knowledge about how something works. It answers the question, 'What happens?' " (Merrill, 2000).
8. User:	Instructional designer
9. ID:	Richard Clark, *What Works in Distance Learning: Instructional Strategies,* Strategies Based on Teaching Process Knowledge, v.5, updated last on 02/03/03. See also O'Neil, H. F. (2003). *What works in distance learning* (Report to the Office of Naval Research). Los Angeles: University of Southern California, Rossier School of Education. Available at [URL to be added]

Strategies Based on Teaching Causal Principles
(Clark, v.5, 02/03/03)

1. Guideline (nontechnical):	When teaching causal principles, the more that the instructional presentation provides a statement about the cause and resulting effects, provides instruction using a worked, prototypical example drawn from the application setting, and helps the learner to first elaborate the elements and sequence of the causal chain and then to apply it to gradually more novel and complex examples, the more effective will be the learning and transfer to the job.
2. Guideline (technical):	Effective instruction on a cause-and-effect principle begins by stating the cause(s) and resulting effect(s) in the principle, then provides an example (a prototype or worked example of an application of the causal principle in a work setting), and then requires practice during instruction that begins with simple examples and moves to more complex examples, in which learners are asked first to describe and label each phase of the cause-and-effect chain in the correct order, and then, when given one phase, to predict the next phase or the previous phase, and then to use the principle to solve increasingly novel problems.
3. Guidelines based on:	Research
4. Degree of confidence:	High
5. Comments:	Effective training often requires that learners understand the conceptual or scientific basis for work processes and procedures. Causal principles reflect the content of some of the most complex knowledge background for technical procedures. Reigeluth (1999) described the many different instructional strategies that have been found to help learners acquire knowledge about causal principles. He suggested first defining the cause-effect relationship (a generality) and then providing a prototypical example. To achieve maximum learner participation, Reigeluth suggested providing opportunities to explore a dynamic example. For instance, in a distance, computer-based lesson on the principles that influence the behavior of light on different types of lenses, the learner might be invited to click on tabs that change the thickness or shape of a lens (cause) and see the path, focal distance and magnification of the image (effects) change correspondingly. During instruction, the display should focus the learner's attention on important elements of the principle and suggest shorthand ways to describe it. Examples and practice exercises should begin with simple worked examples and then gradually present more

	complex, novel and difficult examples. Scaffolding principle instruction requires "prompts" in the form of immediate feedback, suggestions, and praise when the learner is successful.
6. References:	Merrill, M. D. (1983). Component display theory. In C. M. Reigeluth (Ed.), *Instructional design theories and models: An overview of their current status* (pp. 279-333). Hillsdale, NJ: Erlbaum. Reigeluth, C. M. (1999). *Instructional-design theories and models: Volume II*. Mahwah, NJ: Erlbaum. Chapter on teaching principles summarized and retrieved December 4, 2002, from http://www.indiana.edu/~idtheory/methods/module_5_4.html
7. Glossary:	None
8. User:	Instructional designer
9. ID:	Richard Clark, *What Works in Distance Learning: Instructional Strategies,* Strategies Based on Teaching Causal Principles, v.5, updated last on 02/03/03. See also O'Neil, H. F. (2003). *What works in distance learning* (Report to the Office of Naval Research). Los Angeles: University of Southern California, Rossier School of Education. Available at [URL to be added]

Strategies Based on Teaching Procedural ("How to") Knowledge
(Clark, v.5, 02/03/03)

1. Guideline (nontechnical):	When teaching procedures, the more that instruction is based on expert-based descriptions of the sequence of actions and decisions necessary for goal achievement, and is accompanied by a worked example and the opportunity for part-whole practice that is scaffolded to reflect the learner's prior knowledge and accompanied by a conceptual elaboration of the declarative knowledge base supporting the procedure, the more effective will be the learning and transfer of the procedure back to the job environment.
2. Guideline (technical):	Effective instruction about "how to" procedures should provide clear, step-by-step "how to" descriptions of all actions and decisions necessary to achieve a performance goal, modeling (demonstrating) the procedure with a model and/or worked example, providing conceptual knowledge in the form of concepts, processes, and principles that explain why the procedure works and the opportunity to practice the procedure on problems and in settings that mirror the application environment where the procedure will be used.
3. Guidelines based on:	Research
4. Degree of confidence:	High
5. Comments:	"The ultimate aim of training is procedural learning, that is, for trainees to be competent in performing a job" (Druckman & Bjork, 1994, p. 147). Thus learners must be able to translate all instruction into step-by-step actions and decisions, transfer them from training, and apply them appropriately on the job to achieve performance goals. Instructional strategies for teaching procedures require the development of an accurate and clearly described sequence of necessary actions and decisions. Procedures that are derived from expert-based cognitive task analysis (van Merrienboer, Clark, & de Croock, 2002) are preferable. Elaborate expert procedures should be chunked into segments of seven to nine new (to the learner) steps (to avoid cognitive overload) during instruction and accompanied by modeling (worked examples) and conceptual explanations of their underlying principles, processes, and concepts. Where possible, practice of team-based procedures should occur in cooperative groups. When practicing, learners should be asked to explain orally or in writing how a solution was achieved. Practice of parts of a

procedure must be followed by "whole task" practice where procedural chunks are gradually assembled into larger "wholes," and feedback should focus on closing the gap between current and required performance (Druckman & Bjork, 1994, pp. 25-56).

6. References:

Druckman, D., & Bjork, R. A. (1994). *Learning, remembering, believing: Enhancing human performance*. Washington, DC: National Academy Press.

Merrill, M. D. (1983). Component display theory. In C. M. Reigeluth (Ed.), *Instructional design theories and models: An overview of their current status* (pp. 279-333). Hillsdale, NJ: Erlbaum.

van Merrienboer, J. J. G., Clark, R. E., & de Croock, B. M. (2002). Blueprints for complex learning: The 4C/ID-model. *Educational Technology Research and Development, 50*(2), 39-64.

7. Glossary: None.

8. User: Instructional designer

9. ID: Richard Clark, *What Works in Distance Learning: Instructional Strategies,* Strategies Based on Teaching Procedural ("How to") Knowledge, v.5, updated last on 02/03/03. See also O'Neil, H. F. (2003). *What works in distance learning* (Report to the Office of Naval Research). Los Angeles: University of Southern California, Rossier School of Education. Available at [URL to be added]

CHAPTER 3

WHAT WORKS IN DISTANCE LEARNING: MULTIMEDIA

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The following guidelines are presented in this chapter.

1. Strategies Based on Coherence Principle
2. Strategies Based on Modality Principle
3. Strategies Based on Multimedia Principle
4. Strategies Based on Personalization Principle
5. Strategies Based on Pre-Training Principle
6. Strategies Based on Prior Knowledge Principle
7. Strategies Based on Redundancy Principle
8. Strategies Based on Signaling Principle
9. Strategies Based on Spatial Contiguity Principle
10. Strategies Based on Temporal Contiguity Principle
11. Strategies Based on Voice Principle

Strategies Based on Coherence Principle
(Mayer, v.4, 02/03/03)

1. Guideline (nontechnical):	Coherence effect: People learn better from multimedia messages when extraneous words, pictures, and sounds are excluded rather than included.
2. Guideline (technical):	Coherence principle: If creating a multimedia message, then eliminate words, pictures, and sounds that are not directly relevant to the explanation.
3. Guideline based on:	Research
4. Degree of confidence:	High for short multimedia explanations of how something works.
5. Comments:	The guideline is based on a collection of studies, including the following. (1) Students read an illustrated text explaining how lightning storms develop. For some students, a few sentences are added that contain interesting stories and photos about lightning such as what happened when a high school football player was struck (which can be called seductive details). Students performed better on transfer tests when interesting material was excluded rather than included. (2) Students viewed a narrated animation explaining how lightning storms develop or how a car's braking system works. For some students, the presentation included background music and environmental sounds (such as the sound of metal grinding when the brakes went on). Students performed better on transfer tests when the music and sounds were excluded rather than included. (3) Students viewed a narrated animation explaining how lightning storms develop. For some students, the presentation included several interspersed video segments depicting interesting events such as a golfer being carried away after being struck by lightning (which can be called seductive details). Students performed better on transfer tests when the interesting video clips were excluded rather than included.
6. References:	Harp, S. F., & Mayer, R. E. (1997). The role of interest in learning from scientific text and illustrations: On the distinction between emotional interest and cognitive interest. *Journal of Educational Psychology, 89*, 92-102.

Harp, S. F., & Mayer, R. E. (1998). How seductive details do their damage: A theory of cognitive interest in science learning. *Journal of Educational Psychology, 90*, 414-434.

Mayer, R. E., Bove, W., Bryman, A., Mars, R., & Tapangco, L. (1996). When less is more: Meaningful learning from visual and verbal summaries of science textbook lessons. *Journal of Educational Psychology, 88,* 64-78.

Mayer, R. E., Heiser, J., & Lonn, S. (2001) Cognitive constraints on multimedia learning: When presenting more material results in less understanding. *Journal of Educational Psychology, 93,* 187-198.

Moreno, R., & Mayer, R. E. (2000). A coherence effect in multimedia learning: The case for minimizing irrelevant sounds in the design of multimedia messages. *Journal of Educational Psychology, 92,* 117-125.

Mayer, R. E., & Moreno, R. (in press). Nine ways to reduce cognitive load in multimedia learning. *Educational Psychologist, 38*.

7. Glossary: *Seductive detail:* Interesting but extraneous material in a multimedia message (Harp & Mayer, 1998).

8. User: Instructional designer, course manager, program manager

9. ID: Richard Mayer, *What Works in Distance Learning: Multimedia,* Strategies Based on Coherence Principle, v.4, updated last on 02/03/03. See also O'Neil, H. F. (2003). *What works in distance learning* (Report to the Office of Naval Research). Los Angeles: University of Southern California, Rossier School of Education. Available at [URL to be added]

Strategies Based on Modality Principle

(Mayer, v.4, 02/03/03)

1. Guideline (nontechnical):	Modality effect: People learn better from animation and narration than from animation and on-screen text.
2. Guideline (technical):	Modality principle: If creating a fast-paced multimedia message without learner control, then present verbal explanations in spoken form rather than in printed form.
3. Guideline based on:	Research
4. Degree of confidence:	High for short multimedia explanations of how something works, how to carry out a procedure, or why an answer is incorrect.
5. Comments:	The guideline is based on a collection of studies, including the following. (1) Students were asked to view a short animation concerning how lightning storms develop, how a car's braking system works, or how a plant grows. Students who received concurrent narration performed better on subsequent transfer tests than did students who received concurrent on-screen text containing the same words as the narration. (2) Students were given sheets showing the step-by-step solution of various geometry problems. Students who received concurrent taped-recorded speech explaining each step performed better on subsequent transfer tests than did students who received the same words printed on the sheets. (3) Students explored the fuel system of a jet aircraft in a virtual reality environment, and received an explanation of each part they visited. Students who received explanations of each part as narration performed better on subsequent transfer tests than did students who received the same explanations as printed text on a screen in the virtual environment.
6. References:	Mayer, R. E. (2001). *Multimedia learning*. Cambridge: Cambridge University Press. Mayer, R. E., & Moreno, R. (in press). Nine ways to reduce cognitive load in multimedia learning. *Educational Psychologist, 38.* Mayer, R. E., & Moreno, R. (1998). A split-attention effect in multimedia learning: Evidence for dual processing systems in working memory. *Journal of Educational Psychology, 90,* 312-320.

Moreno, R., & Mayer, R. E. (1999). Cognitive principles of multimedia learning: The role of modality and contiguity. *Journal of Educational Psychology, 91,* 358-368.

Moreno, R., Mayer, R. E., Spires, H. A., & Lester, J. C. (2001). The case for social agency in computer-based multimedia: Do students learn more deeply when they interact with animated pedagogical agents? *Cognition and Instruction, 19,* 177-214.

Mousavi, S., Low, R., & Sweller, J. (1995). Reducing cognitive load by mixing auditory and visual presentation modes. *Journal of Educational Psychology, 87,* 319-334.

O'Neil, H. F., Jr., Mayer, R. E., Herl, H. E., Niemi, C., Olin, K., & Thurman, R. A. (2000). Instructional strategies for virtual aviation training environments. In H. F. O'Neil, Jr., & D. H. Andrews (Eds.), *Aircrew training and assessment* (pp. 105-130) Mahwah, NJ: Erlbaum.

Tabbers, H. K., Martens, R. L., & van Merrienboer, J. J. G. (2001). The modality effect in multimedia instruction. In J. D. Moore & K. Stenning (Eds.), *Proceedings of the twenty-third annual conference of the Cognitive Science Society* (pp. 1024-1029). Mahwah, NJ: Erlbaum.

7. Glossary:

Multimedia message: Instructional message consisting of words (e.g., spoken or printed text) and pictures (e.g., illustrations, photos, animation, or video) (Mayer, 2001).

Animation: Moving pictures based on drawings [Mayer, 2001]
Narration: Spoken text (Mayer, 2001).

Explanation: A step-by-step description of how something works or a step-by-step description of how to carry out a procedure (Mayer, 2001).

Transfer: using what was learned to solve new problems (Mayer, 2001).

8. User: Instructional designer, course manager, program manager

9. ID: Richard Mayer, *What Works in Distance Learning: Multimedia,* Strategies Based on Modality Principle, v.4, updated last on 02/03/03. See also O'Neil, H. F. (2003). *What works in distance learning* (Report to the Office of Naval Research). Los Angeles: University of Southern California, Rossier School of Education. Available at [URL to be added]

Strategies Based on Multimedia Principle
(Mayer, v.4, 02/03/03)

1. Guideline (nontechnical):	Multimedia effect: People learn better from corresponding words and graphics (e.g., animation, video, illustrations, pictures) than from words alone.
2. Guideline (technical):	Multimedia principle: If creating a verbal explanation or a verbal description of a procedure, then also present corresponding graphics (e.g., animation, video, illustrations, pictures).
3. Guideline based on:	Research
4. Degree of confidence:	High for short explanations of how something works or how to carry out a procedure.
5. Comments:	The guideline is based on a collection of studies, including the following. (1) Students listened to a short narration concerning how pumps or brakes work. For some students, a corresponding animation was presented depicting the actions described in the narration. Students performed better on transfer tests when they received both narration and animation than when they received words alone. (2) Students read text that explained how pumps work, how brakes work, how electrical generators work, or how lightning storms develop. For some students, a corresponding set of illustrations was presented with each frame depicting actions described in the text. Students performed better when they received both text and illustrations than when they received text alone. (3) Students were better able to learn about the laws of motion from a computer-based lesson that included animated graphics than one without graphics.
6. References:	Mayer, R. E. (2001). Multimedia learning. Cambridge: Cambridge University Press. Mayer, R. E., & Anderson, R. B. (1991). Animations need narrations: An experimental test of the dual-coding hypothesis. *Journal of Educational Psychology, 83,* 484-490. Mayer, R. E., & Anderson, R. B. (1992). The instructive animation: Helping students build connections between words and pictures in multimedia learning. *Journal of Educational Psychology, 84,* 444-452.

Mayer, R. E., & Gallini, J. K. (1990). When is an illustration worth ten thousand words? *Journal of Educational Psychology, 82,* 715-726.

Rieber, L. (1990). Using computer generated graphics in science instruction. *Journal of Educational Psychology, 82,* 135-140.

7. Glossary: None.

8. User: Instructional designer, course manager, program manager

9. ID: Richard Mayer, *What Works in Distance Learning: Multimedia,* Strategies Based on Multimedia Principle, v.4, updated last on 02/03/03. See also O'Neil, H. F. (2003). *What works in distance learning* (Report to the Office of Naval Research). Los Angeles: University of Southern California, Rossier School of Education. Available at [URL to be added]

Strategies Based on Personalization Principle
(Mayer, v.4, 02/03/03)

1. Guideline (nontechnical):	Personalization effect: People learn better from multimedia lessons when the words are in conversational style rather than formal style.
2. Guideline (technical):	Multimedia principle: If creating a verbal explanation or a verbal description of a procedure, then use conversational style (e.g., including first person and second person constructions).
3. Guideline based on:	Research
4. Degree of confidence:	Moderate for short explanations of how something works or how to carry out a procedure.
5. Comments:	The guideline is based on a collection of studies, including the following. (1) Students received a short narrated animation explaining how lightning storms develop. For some students the narration was in formal style (e.g., using third person constructions) whereas for other students the narration was in conversational style (e.g., using first and second person constructions). Students performed better on transfer tests with conversational rather than formal narrations. (2) Students learned how plants grow by viewing narrated animations within the context of an educational game. For some students, the narration was in formal style (e.g., using third person constructions), whereas for other students, the narration was in conversational style (e.g., using first and second person constructions). Students performed better on transfer tests with conversational rather than formal narrations.
6. References:	Mayer, R. E., & Moreno, R. (2002). Animation as an aid to multimedia learning. *Educational Psychology Review, 14*, 87-99. Moreno, R., & Mayer, R. E. (2000). Engaging students in active learning: The case for personalized multimedia messages. *Journal of Educational Psychology, 93,* 724-733. Symons, C. S., & Johnson, B. T. (1997). The self-reference effect in memory: A meta-analysis. *Psychological Bulletin, 121,* 371-394.
7. Glossary:	*Personalization*: Presenting words in conversational style rather than formal style (Moreno & Mayer, 2000).
8. User:	Instructional designer, course manager, program manager

9. ID:	Richard Mayer, *What Works in Distance Learning: Multimedia,* Strategies Based on Personalization Principle, v.4, updated last on 02/03/03. See also O'Neil, H. F. (2003). *What works in distance learning* (Report to the Office of Naval Research). Los Angeles: University of Southern California, Rossier School of Education. Available at [URL to be added]

Strategies Based on Pre-Training Principle
(Mayer, v.4, 02/03/03)

1. Guideline (nontechnical):	Pre-training effect: People learn better from a multimedia presentation when they already know about the components in the presentation.
2. Guideline (technical):	Pre-training principle: If creating a multimedia explanation, then be sure that prior to the presentation learners can visually recognize, name, and describe the behavior of each major component.
3. Guideline based on:	Research
4. Degree of confidence:	Moderately high for short explanations of how something works.
5. Comments:	The guideline is based on a collection of studies, including the following. (1) Students viewed a narrated animation depicting how a car's braking system works. Some students received pre-training in the location, name, and behavior of each component, such as that the piston in the master cylinder could be forward or back. Students who received pre-training learned better from the multimedia explanation than those who received the same training after the presentation. (2) Students viewed a narrated animation depicting how a tire pump works. Some students received pre-training in the location, name, and behavior of each component, such as that the inlet valve could be open or closed. Students who received pre-training learned better from the multimedia explanation than those who did not.
6. References:	Mayer, R. E., Mathias, A., & Wetzell, K. (2002). Fostering understanding of multimedia messages through pre-training: Evidence for a two-stage theory of mental model construction. *Journal of Experimental Psychology: Applied, 8,* 147-154.
7. Glossary:	*Pre-training:* Prior to presenting a multimedia lesson, making sure that learners know about each component or element in the lesson (Mayer, Mathias, & Wetzell, 2002).
8. User:	Instructional designer, course manager, program manager
9. ID:	Richard Mayer, *What Works in Distance Learning: Multimedia,* Strategies Based on Pre-Training Principle, v.4, updated last on 02/03/03. See also O'Neil, H. F. (2003). *What works in distance*

learning (Report to the Office of Naval Research). Los Angeles: University of Southern California, Rossier School of Education. Available at [URL to be added]

Strategies Based on Prior Knowledge Principle
(Mayer, v.4, 02/03/03)

1. Guideline (nontechnical):	Prior knowledge effect: Low-knowledge learners benefit more from well-designed multimedia messages than do high-knowledge learners.
2. Guideline (technical):	Prior knowledge principle: If creating a multimedia explanation for low knowledge learners, then be sure to follow applicable design principles.
3. Guideline based on:	Research
4. Degree of confidence:	Moderately high for short explanations of how something works.
5. Comments:	The guideline is based on a collection of studies, including the following. (1) Students received text and illustrations depicting how a lightning storms develop. For some students, the text was presented near the corresponding graphic (integrated presentation), whereas for others, the text was presented far from the corresponding graphic (separated presentation). The positive effects of integrated presentation were strong for low prior knowledge learners but not for high prior knowledge learners. (2) Students received text and illustrations explaining the operation of a bell-and-light circuit. For some students, the text was presented near the corresponding graphic (integrated presentation), whereas for others, the text was presented far from the corresponding graphic (separated presentation). The positive effects of integrated presentation were strong for low prior knowledge learners but not for high prior knowledge learners.
6. References:	Kalyuga, S., Chandler, P., & Sweller, J. (1998). Levels of expertise and instructional design. *Human Factors, 40,* 1-17. Kalyuga, S., Chandler, P., & Sweller, J. (2000). Incorporating learner experience into the design of multimedia instruction. *Journal of Educational Psychology, 92,* 126-136. Mayer, R. E. (2001). *Multimedia learning*. Cambridge: Cambridge University Press. Mayer, R. E., & Gallini, J. (1990). When is an illustration worth ten thousand words? *Journal of Educational Psychology, 82,* 715-726.

Mayer, R. E., Steinhoff, K., Bower, G., & Mars, R. (1995). A generative theory of textbook design: Using annotated illustrations to foster meaningful learning of science text. *Educational Technology Research and Development, 43,* 31-43.

7. Glossary: None.

8. User: Instructional designer, course manager, program manager

9. ID: Richard Mayer, *What Works in Distance Learning: Multimedia,* Strategies Based on Prior Knowledge Principle, v.4, updated last on 02/03/03. See also O'Neil, H. F. (2003). *What works in distance learning* (Report to the Office of Naval Research). Los Angeles: University of Southern California, Rossier School of Education. Available at [URL to be added]

Strategies Based on Redundancy Principle
(Mayer, v.4, 02/03/03)

1. Guideline (nontechnical):	Redundancy effect: People learn better from animation and narration than from animation, narration, and on-screen text.
2. Guideline (technical):	Redundancy principle: If creating a fast-paced multimedia message without learner control, then present verbal explanations solely in spoken form rather than in both spoken form and printed form.
3. Guideline based on:	Research
4. Degree of confidence:	High for short multimedia explanations of how something works or how to carry out a procedure.
5. Comments:	The guideline is based on a collection of studies, including the following. (1) Students were asked to view a short animation concerning how lightning storms develop along with corresponding narration. For some students, on-screen text was presented at the bottom of the screen corresponding to the words in the narration. Students performed better on transfer tests when on-screen text was not added to the narrated animation. (2) People learned how to solder metals in a computer-based program consisting of on-screen diagrams and accompanying narration. Some learners also received on-screen text that duplicated the words in the narration. Students learned better when on-screen text was not added to the narrated animation.
6. References:	Kalyuga, S., Chandler, P., & Sweller, J. (1999). Managing split-attention and redundancy in multimedia learning. *Applied Cognitive Psychology, 13,* 351-372. Mayer, R. E., Heiser, J., & Lonn, S. (2001). Cognitive constraints on multimedia learning: When presenting more material results in less understanding. *Journal of Educational Psychology, 93,* 187-198. Mayer, R. E., & Moreno, R. (in press). Nine ways to reduce cognitive load in multimedia learning. *Educational Psychologist, 38.* Moreno, R., & Mayer, R. E. (2002). Verbal redundancy in multimedia learning: When reading helps listening. *Journal of Educational Psychology, 94,* 156-163.

7. Glossary:	*Redundancy*: Presenting the same verbal message in printed and spoken form (Mayer, 2001).
8. User:	Instructional designer, course manager, program manager
9. ID:	Richard Mayer, *What Works in Distance Learning: Multimedia,* Strategies Based on Redundancy Principle, v.4, updated last on 02/03/03. See also O'Neil, H. F. (2003). *What works in distance learning* (Report to the Office of Naval Research). Los Angeles: University of Southern California, Rossier School of Education. Available at [URL to be added]

Strategies Based on Signaling Principle
(Mayer, v.4, 02/03/03)

1. Guideline (nontechnical):	Signaling effect: People learn better from narrated animations when the narration highlights the key steps and the links between them.
2. Guideline (technical):	Signaling principle: If creating a multimedia explanation with narration, then organize the narration to include a preview summary that outlines the main steps, section headings that correspond to the main steps, and pointer words such as *first, second, third* or *as a result*.
3. Guideline based on:	Research
4. Degree of confidence:	Moderately high for short explanations of how something works or descriptions of how to carry out a procedure.
5. Comments:	The guideline is based on a collection of studies, including the following. (1) Students learned how airplanes achieve lift from a narrated animation. A signaled version included a preview summary outlining three main steps in the process, headings corresponding to the three steps, and pointer words such as *as a result*. Students who received the signaled version performed better on a transfer test than did students who received the non-signaled version. (2) Students read a passage about how the red tide happens. A signaled version included a preview summary outlining three main steps in the process, paragraph headings corresponding to these three steps, and pointer words such as *first, second, third*. Students who received the signaled version performed better on a transfer test than did students who received the non-signaled version.
6. References:	Mautone, P. D., & Mayer, R. E. (2001). Signaling as a cognitive guide in multimedia learning. *Journal of Educational Psychology, 93,* 377-389. Loman, N. L., & Mayer, R. E. (1983). Signaling techniques that increase the understandability of expository prose. *Journal of Educational Psychology, 75,* 402-412. Lorch, R. F., Jr. (1989). Text signaling devices and their effects on reading and memory processes. *Educational Psychology Review, 1,* 209-234.

7. Glossary:	*Signaling*: Adding a summary preview that outlines the steps in a process or explanation, headings that correspond to the steps, and pointer words such as *first, second, third* (Mautone & Mayer, 2001).
8. User:	Instructional designer, course manager, program manager
9. ID:	Richard Mayer, *What Works in Distance Learning: Multimedia,* Strategies Based on Signaling Principle, v.4, updated last on 02/03/03. See also O'Neil, H. F. (2003). *What works in distance learning* (Report to the Office of Naval Research). Los Angeles: University of Southern California, Rossier School of Education. Available at [URL to be added]

Strategies Based on Spatial Contiguity Principle
(Mayer, v.4, 02/03/03)

1. Guideline (nontechnical):	Spatial contiguity effect: People learn better when corresponding words and graphics are placed near rather than far from each other on the screen.
2. Guideline (technical):	Spatial contiguity principle: If presenting a multimedia message consisting of graphics and printed words, then place each set of printed words near rather than far from the portion of the graphic they describe.
3. Guideline based on:	Research
4. Degree of confidence:	High for short multimedia explanations of how something works.
5. Comments:	The guideline is based on a collection of studies, including the following. (1) Students viewed an animation depicting how lightning storms develop. Corresponding on-screen text was either placed at the bottom of the frame as a caption (separated presentation) or next to the portion of the animation that it described (integrated presentation). Students performed better on transfer tests with the integrated presentation. (2) Students read a text with illustrations explaining how lightning storms develop or how a car's braking system works. The text was either placed on a separate page (separated presentation) or next to the portion of the illustration that it described (integrated presentation). Students performed better on transfer tests with the integrated presentation. (3) Students received instruction in how to solve geometry problems that included graphics and text. The text was either placed on a separate page (separated presentation) or next to the portion of the illustration that it described (integrated presentation). Students performed better on transfer tests with the integrated presentation, presumably because it eliminates *split attention*.
6. References:	Mayer, R. E. (1989). Systematic thinking fostered by illustrations in scientific text. *Journal of Educational Psychology, 81,* 240-246. Mayer, R. E., & Moreno, R. (in press). Nine ways to reduce cognitive load in multimedia learning. *Educational Psychologist, 38.* Mayer, R. E., Steinhoff, K., Bower, G., & Mars, R. (1995). A generative theory of textbook design: Using annotated illustrations

to foster meaningful learning of science text. *Educational Technology Research and Development, 43,* 31-43.

Moreno, R., & Mayer, R. E. (1999). Cognitive principles of multimedia learning: The role of modality and contiguity. *Journal of Educational Psychology, 91,* 358-368.

Paas, F. G. W. C., & van Merrienboer, J. J. G. (1994). Variability of worked examples and transfer of geometric problem solving skills: A cognitive load approach. *Journal of Educational Psychology, 86,* 122-133.

Sweller, J., & Chandler, P. (1994). Why some material is difficult to learn. *Cognition and Instruction, 12,* 185-233.

Sweller, J., Chandler, P., Tierney, P., & Cooper, M. (1990). Cognitive load and selective attention as factors in the structuring of technical material. *Journal of Experimental Psychology: General, 119,* 176-192.

7. Glossary: *Split attention presentations:* Multimedia presentations in which corresponding words and graphics are not placed near each other (Sweller, 1999).

8. User: Instructional designer, course manager, program manager

9. ID: Richard Mayer, *What Works in Distance Learning: Multimedia,* Strategies Based on Spatial Contiguity Principle, v.4, updated last on 02/03/03. See also O'Neil, H. F. (2003). *What works in distance learning* (Report to the Office of Naval Research). Los Angeles: University of Southern California, Rossier School of Education. Available at [URL to be added]

Strategies Based on Temporal Contiguity Principle
(Mayer, v.4, 02/03/03)

1. Guideline (nontechnical):	Temporal contiguity effect: People learn better when corresponding animation and narration segments are presented simultaneously.
2. Guideline (technical):	Temporal contiguity principle: If creating a fast-paced multimedia message without learner control, then present corresponding animation and narration segments at the same time.
3. Guideline based on:	Research
4. Degree of confidence:	High for short multimedia explanations of how something works or how to carry out a procedure.
5. Comments:	The guideline is based on a collection of studies, including the following. (1) Students viewed a short animation depicting how a pump works, how the human lungs work, how a car's braking system works, or how lightning storms develop. Corresponding narration was presented either simultaneously with the animation, after the animation, or before the animation. Students performed better on transfer tests when corresponding narration and animation were presented simultaneously. (2) Students watched a film showing how to assemble some parts from a kit. Students performed better when the sound track corresponded to actions being depicted in the film than when the sound track preceded or followed the corresponding visual material by 14 seconds or more.
6. References:	Baggett, P. (1984). Role of temporal overlap of visual and auditory material in forming dual media associations. *Journal of Educational Psychology, 76,* 408-417. Mayer, R. E., & Anderson, R. B. (1991). Animations need narrations: An experimental test of a dual-coding hypothesis. *Journal of Educational Psychology, 83,* 484-490. Mayer, R. E., & Anderson, R. B. (1992). The instructive animation: Helping students build connections between words and pictures in multimedia learning. *Journal of Educational Psychology, 84*, 444-452.

Mayer, R. E., & Moreno, R. (in press). Nine ways to reduce cognitive load in multimedia learning. *Educational Psychologist, 38.*

Mayer, R. E., Moreno, R., Boire, M., & Vagge, S. (1999). Maximizing constructivist learning from multimedia communications by minimizing cognitive load. *Journal of Educational Psychology, 91,* 638-643.

Mayer, R. E., & Sims, V. K. (1994). For whom is a picture worth a thousand words? Extensions of a dual-coding theory of multimedia learning. *Journal of Educational Psychology, 84,* 389-401.

7. Glossary: None.

8. User: Instructional designer, course manager, program manager

9. ID: Richard Mayer, *What Works in Distance Learning: Multimedia,* Strategies Based on Temporal Contiguity Principle, v.4, updated last on 02/03/03. See also O'Neil, H. F. (2003). *What works in distance learning* (Report to the Office of Naval Research). Los Angeles: University of Southern California, Rossier School of Education. Available at [URL to be added]

Strategies Based on Voice Principle
(Mayer, v.4, 02/03/03)

1. Guideline (nontechnical):	Voice effect: People learn better from narrated animations when the narration has a human voice with a standard accent rather than a machine voice or an accented voice.
2. Guideline (technical):	Voice principle: If creating a multimedia lesson with narration, then present the narration using a human voice with standard accent.
3. Guideline based on:	Research
4. Degree of confidence:	Moderately high for short explanations of how something works or descriptions of how to carry out a procedure.
5. Comments:	The guideline is based on a collection of studies, including the following. (1) Students listened to a short narrated animation concerning how lightning storms develop. Students performed better on transfer tests when the narration consisted of a human voice rather than a machine-simulated voice. (2) Students listened to a short narrated animation concerning how lightning storms develop. Students performed better on transfer tests when the narration consisted of a human voice with standard accent rather than a human voice with a foreign accent.
6. References:	Mayer, R. E., & Moreno, R. (in press). Nine ways to reduce cognitive load in multimedia learning. *Educational Psychologist, 38*. Mayer, R. E., Sobko, K., & Mautone, P. D. (in press). Social cues in multimedia learning: Role of speaker's voice. *Journal of Educational Psychology, 94*. Oviatt, S., & Adams, B. (2000). Designing and evaluating conversational interfaces with animated characters. In J. Cassell, J. Sullivan, S. Prevost, & E. Churchill (Eds.), *Embodied conversational agents* (pp. 319-345). Cambridge, MA: MIT Press.
7. Glossary:	None.
8. User:	Instructional designer, course manager, program manager

9. ID: Richard Mayer, *What Works in Distance Learning: Multimedia,* Strategies Based on Voice Principle, v.4, updated last on 02/03/03. See also O'Neil, H. F. (2003). *What works in distance learning* (Report to the Office of Naval Research). Los Angeles: University of Southern California, Rossier School of Education. Available at [URL to be added]

CHAPTER 4

WHAT WORKS IN DISTANCE LEARNING: LEARNING STRATEGIES

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The following guidelines are presented in this chapter.

1. Strategies Based on Text Summarization
2. Strategies Based on Annotation
3. Strategies Based on Visual Representations
4. Strategies Based on Elaborative Interrogation
5. Strategies Based on Elaborative Verbal Rehearsal
6. Strategies Based on Generation of Higher Level Questions
7. Strategies Based on Outline-Formatted Notes
8. Strategies Based on Test Preparation
9. Strategies Based on Help Seeking
10. Strategies Based on Time Management
11. Strategies Based on Goal Setting
12. Strategies Based on Test Anxiety Reduction

Strategies Based on Text Summarization
(Dembo and Gubler Junge, v.5, 02/21/03)

1. Guideline (nontechnical): Students who summarize readings comprehend and recall more than those who do not.

2. Guideline (technical): If students summarize readings, then comprehension and recall improve.

3. Guideline based on: Research

4. Degree of confidence: High

5. Comments: The process of summarizing text after reading provides students the opportunity to both generate meaning and monitor understanding. When summarizing, students make connections between words, sentences, paragraphs, and concepts in the text in addition to making connections to personal knowledge and experience; through this process, personal meaning is generated and ideas are elaborated on as they are organized in essay form (Wittrock, 1990). This generative process that requires elaboration and organization facilitates the process of depositing information into long-term memory for later recall (King, 1992). Summarization activities direct attention to academic tasks and allow students to monitor what they do and do not understand. They are prepared to review concepts and reread as necessary. Summarizing text is also beneficial in the test preparation process because students must adequately comprehend the material in order to put it into their own words.

Students in distance learning settings work independently, without the direct assistance of peers and/or instructors. Therefore, it is important that they be able to monitor their own learning, elaborate upon it, and organize it in order to recall it later and improve comprehension.

6. References:

Dembo, M. (2000). *Motivation and learning strategies for college success*. Mahwah, NJ: Erlbaum.

King, A. (1992). Comparison of self-questioning, summarizing, and note taking review as strategies for learning from lectures. *American Educational Research Journal, 29*, 303-323.

Simpson, M., & Nist, S. (2000). An update on strategic learning: It's more than textbook reading strategies. *Journal of Adolescent & Adult Literacy, 43*, 528-542.

Wittrock, M. C. (1990). Generative processes of comprehension. *Educational Psychologist, 24*, 345-376.

7. Glossary:

Elaboration: Integrating meaningful knowledge into long-term memory through adding detail, summarizing, creating examples and analogies (Dembo, 2000).

Generative process: The construction of meaning by building relations among the parts of the text and between the text and personal knowledge and experience (Wittrock, 1990).

Summarization: Condensing the main points of a text into one's own words (Wittrock, 1990).

8. User: Instructional designer

9. ID: Myron H. Dembo and Linda Gubler Junge, *What Works in Distance Learning: Learning Strategies,* Strategies Based on Text Summarization, v.5, updated last on 02/21/03. See also O'Neil, H. F. (2003). *What works in distance learning* (Report to the Office of Naval Research). Los Angeles: University of Southern California, Rossier School of Education. Available at [URL to be added]

Strategies Based on Annotation
(Dembo and Gubler Junge, v.5, 02/21/03)

1. Guideline (nontechnical): Annotating text while reading improves comprehension.

2. Guideline (technical): If students annotate text material while reading, then comprehension improves.

3. Guideline based on: Research

4. Degree of confidence: High

5. Comments: Annotation takes less time than traditional strategies like rereading, outlining, and taking notes, and it is more useful than highlighting because it is an active, not a passive, process. It requires connecting to prior knowledge and experiences, as well as elaboration of ideas. When students annotate a text, they actively interact with it much as they would when conversing with another individual. It is important that students focus on ideas in annotations instead of topics. Perhaps the greatest selling point of annotation is that it naturally lends itself to test preparation activities and review. Students do not have to begin test preparation by distinguishing what is important from what is not important. This decision was made during the annotation process, as was generating potential test questions, and identifying concepts that were not understood.

   Annotation proves especially valuable when students find themselves isolated in a distance learning environment. This process aids them in finding the main point and guides understanding in an interactive way.

6. References:

Dembo, M. (2000). *Motivation and learning strategies for college success*. Mahwah, NJ: Erlbaum.

Nist, S., & Hogrebe, M. (1987). The role of underlining and annotating in remembering textual information. *Reading Research and Instruction, 27*(1), 12-25.

Nist, S., & Holschuh, J. (2000). Comprehension strategies at the college level. In R. F. Flippo & D. C. Caverly (Eds.), *Handbook of college reading and study strategy research* (pp. 75-104). Mahwah, NJ: Erlbaum.

Simpson, M., & Nist, S. (1990). Textbook annotation: An effective and efficient study strategy for college students. *Journal of Reading, 34*, 122-129.

7. Glossary:

Annotate: To state key ideas briefly in one's own words in the margins of the text; and/or to enumerate multiple ideas (i.e., causes, effects, characteristics) in an organized fashion; and/or to note examples of concepts in the margin by writing EX; and/or to put key information on graphs and charts with the text when appropriate; and/or to jot down possible test questions; and/or to note puzzling or confusing ideas with a question mark in the margin; and/or to selectively underline key words or phrases (Simpson & Nist, 1990).

Elaboration: Integrating meaningful knowledge into long-term memory through adding detail, summarizing, creating examples and analogies (Dembo, 2000).

8. User: Instructional designer

9. ID: Myron H. Dembo and Linda Gubler Junge, *What Works in Distance Learning: Learning Strategies,* Strategies Based on Annotation, v.5, updated last on 02/21/03. See also O'Neil, H. F. (2003). *What works in distance learning* (Report to the Office of Naval Research). Los Angeles: University of Southern California, Rossier School of Education. Available at [URL to be added]

Strategies Based on Visual Representations
(Dembo and Gubler Junge, v.5, 02/21/03)

1. Guideline (nontechnical): Visual representation of text material is helpful in improving comprehension of complex material.

2. Guideline (technical): If synthesizing and elaborating information contained in complex expository texts is required, then visual representations can be used to increase comprehension of the material.

3. Guideline based on: Research

4. Degree of confidence: Moderate

5. Comments: Reading involves two processes: comprehension and retention. Just because textbook material is comprehended does not mean that it will be retained. Additional steps such as visual representations improve comprehension of detailed material, and also improve retention and performance. When students are left primarily to themselves to read, comprehend, and retain material, as is the case in distance learning settings, visual representations are especially helpful, once students have been trained how and when to use them.

Visual representations come with a variety of names and formats—graphic organizers, concept maps, hierarchies, matrices, flow charts, etc. It is generally believed that in order to gain maximum benefit from employing visual representations, a training period on when and how to use them is necessary. Visual representations are most helpful when produced after reading because the students then have the information to represent and organize. Visually representing materials requires students to spend additional time with the content, going more in-depth with it as a representation is generated. This additional time allows opportunity for the synthesis of concepts and the clarification of relationships when dealing with complex material. This process could be especially helpful if multiple texts are involved because the material can be brought together and synthesized in one visual representation that shows how the content is interrelated.

6. References: Bernard, R., & Naidu, S. (1992). Post-questioning, concept mapping and feedback: A distance education field experiment. *British Journal of Educational Technology, 23*, 48-60.

Dembo, M. (2000). *Motivation and learning strategies for college success*. Mahwah, NJ: Erlbaum.

Moore, D., & Readence, J. (1984). A quantitative and qualitative review of graphic organizer research. *Journal of Educational Research, 78*, 11-17.

Nist, S., & Holschuh, J. (2000). Comprehension strategies at the college level. In R. F. Flippo & D. C. Caverly (Eds.), *Handbook of college reading and study strategy research* (pp. 75-104). Mahwah, NJ: Erlbaum.

7. Glossary:

Elaboration: Integration of meaningful knowledge into long-term memory through adding detail, summarizing, creating examples and analogies (Dembo, 2000).

Hierarchy: An organization of ideas into levels and groups (Dembo, 2000).

Matrix: An organization that displays the comparative relations existing within and across topics (Dembo, 2000).

8. User: Instructional designer

9. ID: Myron H. Dembo and Linda Gubler Junge, *What Works in Distance Learning: Learning Strategies,* Strategies Based on Visual Representations, v.5, updated last on 02/21/03. See also O'Neil, H. F. (2003). *What works in distance learning* (Report to the Office of Naval Research). Los Angeles: University of Southern California, Rossier School of Education. Available at [URL to be added]

Strategies Based on Elaborative Interrogation
(Dembo and Gubler Junge, v.5, 02/21/03)

1. Guideline (nontechnical): Students who interact with texts by forming and answering questions based on readings show greater comprehension.

2. Guideline (technical): If elaborative interrogation strategies are employed while interacting with the text, then comprehension is monitored and improved.

3. Guideline based on: Research

4. Degree of confidence: High

5. Comments: Elaborative interrogation means that students interact with a text by forming and answering questions based on the reading, thereby turning what was a passive reading process into an active one. Knowledge is actively constructed as questions are formed, as relations between concepts are clarified, and as prior knowledge is accessed to answer questions. Engaging prior knowledge is key in gaining meaningful understanding that relates to what students already know and have experienced. One elaborative interrogation strategy that helps monitor comprehension and focus attention is to turn text headings and subheadings into questions. For example, if "The Industrial Revolution" was a textbook heading in an economics book, it would be turned into a question like "What was the impact of the Industrial Revolution on the world economy?" This activity prepares students to identify the main point of a passage, a task that many adults do not do effectively (Pressley, Symons, McDaniel, Snyder, & Turnure, 1990). Another elaborative interrogation strategy that positively impacts learning is for learners to continually ask "why," "what," or "how" questions in their minds during reading. This process allows students to focus their attention, to monitor what is being understood, and to see where there may be gaps in comprehension. It also provides opportunity for further elaboration of ideas (extensions, inferences, etc.).

Distance learners need to use effective learning strategies such as elaborative interrogation if they are to succeed in their autonomous setting. Students are prone to miss key ideas without an instructor present to answer questions and clarify main points. Elaborative interrogation guides students' attention so that they will not miss the main points of the content.

6. References:

Dembo, M. (2000). *Motivation and learning strategies for college success*. Mahwah, NJ: Erlbaum.

Nist, S., & Holschuh, J. (2000). Comprehension strategies at the college level. In R. F. Flippo & D. C. Caverly (Eds.), *Handbook of college reading and study strategy research* (pp. 75-104). Mahwah, NJ: Erlbaum.

Pressley, M., Ghatala, E., Woloshyn, V., & Pirie, J. (1990). Sometimes adults miss the main ideas and do not realize it: Confidence in responses to short-answer and multiple-choice comprehension questions. *Reading Research Quarterly, 25*, 232-249.

Pressley, M., Symons, S., McDaniel, M., Snyder, B., & Turnure, J. (1988). Elaborative interrogation facilitates acquisition of confusing facts. *Journal of Educational Psychology, 80*, 268-278.

Rosenshine, B., Meister, C., & Chapman, S. (1996). Teaching students to generate questions: A review of the intervention studies. *Review of Educational Research, 66*, 181-221.

Woloshyn, V., Wood, E., Willoughby, T., & Pressley, M. (1990). Elaborative interrogation facilitates adult learning of factual paragraphs. *Journal of Educational Psychology, 82*, 513-524.

7. Glossary:

Elaboration: Integrating meaningful knowledge into long-term memory through adding detail, summarizing, creating examples and analogies (Dembo, 2000).

Interrogation: The process through which questions are generated and answered (Pressley et al., 1988).

8. User: Instructional designer

9. ID: Myron H. Dembo and Linda Gubler Junge, *What Works in Distance Learning: Learning Strategies,* Strategies Based on Elaborative Interrogation, v.5, updated last on 02/21/03. See also O'Neil, H. F. (2003). *What works in distance learning* (Report to the Office of Naval Research). Los Angeles: University of Southern California, Rossier School of Education. Available at [URL to be added]

Strategies Based on Elaborative Verbal Rehearsal
(Dembo and Gubler Junge, v.5, 02/21/03)

1. Guideline (nontechnical): When students explain a concept or idea out loud, either to another person or an imaginary audience, their comprehension improves.

2. Guideline (technical): If elaborative verbal rehearsal strategies are used, then performance on recall and recognition measures is enhanced.

3. Guideline based on: Research

4. Degree of confidence: High

5. Comments: The idea that the teacher often learns more than the students is embodied in the elaborative verbal rehearsal strategy, wherein students verbally explain, either to another person or an imagined audience, material that was learned in a lecture, or in a reading assignment. Generalizations are constructed, personal examples are provided, and applications are offered as the information is verbally rehearsed. In this way students move away from less meaningful rote learning and are able to elaborate on the learned information, making it meaningful. They also become aware of what is not well understood, and are thus prepared to reread, ask questions, and seek help as necessary. For example, a student preparing for a test on material about the Industrial Revolution would verbally explain to another (a friend at work, a reflection in a mirror, or even a pillow named "Ed") what the Industrial Revolution was all about, what brought it on, and what the effects of it on the world have been. This verbal review helps students tie concepts together, know what they understand and what they don't, and prepare for tests.

Elaborative verbal rehearsals are another checkpoint where distance learners pause to reflect on what was learned and understood. Working independently with an imaginary audience or with a real audience allows students to self-monitor, become aware of what they understand, and make the material meaningful through personal examples.

6. References: Dembo, M. (2000). *Motivation and learning strategies for college success*. Mahwah, NJ: Erlbaum.

Pressley, M., Wood, E., Woloshyn, V., Martin, V., King, A., & Menke, D. (1992). Encouraging mindful use of prior knowledge: Attempting to construct explanatory answers facilitates learning. *Educational Psychologist, 27*, 91-109.

Simpson, M., & Nist, S. (2000). An update on strategic learning: It's more than textbook reading strategies. *Journal of Adolescent & Adult Literacy, 43*, 528-542.

Simpson, M., Olejnik, S., Tam, A., & Supattathum. (1994). Elaborative verbal rehearsals and college students' cognitive performance. *Journal of Educational Psychology, 86*, 267-278.

Spires, H., & Donley, J. (1998). Prior knowledge activation: Inducing engagement with informational texts. *Journal of Educational Psychology, 90*, 249-260.

7. Glossary:

Elaboration: Integrating meaningful knowledge into long-term memory through adding detail, summarizing, creating examples and analogies (Dembo, 2000).

Meaningful learning: A process of learning whereby a student attempts to make sense of the material so it will be stored in long-term memory and retrieved when needed (Dembo, 2000).

Rehearsal: The process of repeating information, synthesized with personal experiences and examples, verbally to another person, or to an imaginary audience (Simpson et al., 1994).

Rote learning: A process of learning whereby students learn through repetition without trying to make any sense of the material (Dembo, 2000).

8. User: Instructional designer

9. ID: Myron H. Dembo and Linda Gubler Junge, *What Works in Distance Learning: Learning Strategies,* Strategies Based on Elaborative Verbal Rehearsal, v.5, updated last on 02/21/03. See also O'Neil, H. F. (2003). *What works in distance learning* (Report to the Office of Naval Research). Los Angeles: University of Southern California, Rossier School of Education. Available at [URL to be added]

Strategies Based on Generation of Higher Level Questions
(Dembo and Gubler Junge, v.5, 02/21/03)

1. Guideline (nontechnical):	When thought-provoking questions about learned material are generated by students, deeper understanding and higher academic performance results.
2. Guideline (technical):	If higher level question stems are used in student-generated questions, then comprehension improves.
3. Guideline based on:	Research
4. Degree of confidence:	High
5. Comments:	Higher level questions are thought-provoking questions that require synthesis, elaboration, application, and prediction of ideas (i.e., What are the strengths and weaknesses of . . . ? How does . . . affect . . . ? Why is . . . important? Compare . . . and . . . with regard to . . . . etc.; see King, 1992). These questions can be formed before, during, and/or after reading. Before reading, predictions can be made; during reading, inferences and examples emerge; and after reading, synthesis and application of ideas are possible. Prior knowledge is engaged to explain and connect concepts, and learning is deposited into long-term memory. Using a variety of such question stems encourages students to think about a given concept in different ways, and when this process is used by pairs or groups of students, different perspectives must be addressed. Similarly, group questioning provides opportunities for individuals to think about what they understood and be confronted by what they might not have understood. Research shows that groups and individuals that use higher level question stems show greater achievement on academic measures (King, 1992). Some training in generating higher level questions may be necessary in order for students to benefit fully from their use. This activity is a particularly effective learning strategy for distance learners. They can use higher level questions whether interacting with written text, Internet peer chats, or virtual lectures. Higher level questions can be used to self-test as a test preparation strategy with the goal of predicting actual test questions.
6. References:	Dembo, M. (2000). *Motivation and learning strategies for college success*. Mahwah, NJ: Erlbaum.

King, A. (1990). Enhancing peer interaction and learning in the classroom through reciprocal questioning. *American Educational Research Journal, 27*, 664-687.

King, A. (1992). Facilitating elaborative learning through guided student-generated questioning. *Educational Psychologist, 27*, 111-126.

Simpson, M., & Nist, S. (2000). An update on strategic learning: It's more than textbook reading strategies. *Journal of Adolescent & Adult Literacy, 43*, 528-542.

Wittrock, M. (1992). Generative learning processes of the brain. *Educational Psychologist, 27*, 531-541.

7. Glossary:

Elaboration: Integrating meaningful knowledge into long-term memory through adding detail, summarizing, creating examples, and making analogies (Dembo, 2000).

Higher level questions: Thought-provoking questions that require synthesis, elaboration, application, and prediction of ideas (King, 1992).

Long-term memory: Memory over extended periods of time, ranging from hours to days and years. Long-term memory is the permanent repository for acquired information.

8. User: Instructional designer

9. ID: Myron H. Dembo and Linda Gubler Junge, *What Works in Distance Learning: Learning Strategies,* Strategies Based on Generation of Higher Level Questions, v.5, updated last on 02/21/03. See also O'Neil, H. F. (2003). *What works in distance learning* (Report to the Office of Naval Research). Los Angeles: University of Southern California, Rossier School of Education. Available at [URL to be added]

Strategies Based on Outline-Formatted Notes
(Dembo and Gubler Junge, v.5, 02/21/03)

1. Guideline (nontechnical): Students who take and review outline-style notes comprehend more than students who do not.

2. Guideline (technical): If outline-formatted notes are taken and periodically reviewed, then comprehension increases.

3. Guideline based on: Research

4. Degree of confidence: Moderate

5. Comments: The number of ideas included in notes is positively related to test performance. In other words, the more extensive notes students have, the better their chances are of performing well on academic measures. Research has been conducted showing that the process of taking notes aids later recall of material, and that reviewing notes is correlated with higher test scores (Kiewra, Benton, Kim, Risch, & Christensen, 1995). The outline format of notes is generally seen as an effective way of aiding both the process of note-taking (getting down all the key ideas) and the product of note-taking (test-review and performance). Students that are left to note-take without specific guidance are reported to gather only 30% of the key ideas (Kiewra et al., 1995). This percentage significantly increases when the outline format is used. The internal connections between ideas become more apparent when notes are taken in outline format. This understanding of the relationship between concepts prepares students to relate the material to prior knowledge and elaborate on it mentally, reaching deeper understanding. It is important to mention that the cited research was conducted in a lecture-based setting. However, there is reason to believe that findings transfer to the text-based setting.

   Since students in distance learning settings generally do not have the opportunity to both read the material and hear it in a lecture, the quality of their notes taken during reading is an important factor in retention of material.

6. References: Dembo, M. (2000). *Motivation and learning strategies for college success*. Mahwah, NJ: Erlbaum.

   Kiewra, K. (1989). A review of note-taking: The encoding-storage paradigm and beyond. *Educational Psychology Review, 1*, 147-172.

Kiewra, K., & Benton, S. (1988). The relationship between information-processing ability and notetaking. *Contemporary Educational Psychology, 13*, 33-44.

Kiewra, K., Benton, S., Kim, S., Risch, N., & Christensen, M. (1995). Effects of note-taking format and study technique on recall and relational performance. *Contemporary Educational Psychology, 20*, 172-187.

Simpson, M., & Nist, S. (2000). An update on strategic learning: It's more than textbook reading strategies. *Journal of Adolescent & Adult Literacy, 43*, 528-542.

7. Glossary:

Elaboration: Integrating meaningful knowledge into long-term memory through adding detail, summarizing, creating examples and analogies (Dembo, 2000).

Outline: Information grouped into subordinate relationship in notes, with topic headings extending farther to the left while subordinate ideas are included under the superordinate ideas and indented to the right (Kiewra et al., 1995).

8. User: Instructional designer

9. ID: Myron H. Dembo and Linda Gubler Junge, *What Works in Distance Learning: Learning Strategies,* Strategies Based on Outline-Formatted Notes, v.5, updated last on 02/21/03. See also O'Neil, H. F. (2003). *What works in distance learning* (Report to the Office of Naval Research). Los Angeles: University of Southern California, Rossier School of Education. Available at [URL to be added]

Strategies Based on Test Preparation
(Dembo and Gubler Junge, v.5, 02/21/03)

1. Guideline (nontechnical): Students who adjust their study strategies to match testing demands have higher test scores than those who do not.

2. Guideline (technical): If students adjust their study strategies to match testing demands, then test scores are higher.

3. Guideline based on: Research

4. Degree of confidence: High

5. Comments: Students who adjust their test-taking strategies according to the demands of the test have higher test scores (Pressley, Yokoi, van Meter, Van Etten, & Freebern, 1997). The requirements of a history test may be different from the requirements of a math test. The history test may focus on memory for names and dates, whereas the math test may require application of concepts. Similarly, the test in one professor's history class may require different things than the test of a different history professor. Memory-focused tests have different cognitive demands than do application-type tests. Therefore different study strategies will need to be employed. Morris, Bransford, and Franks (1977) called the ability of students to choose appropriate strategies for the individual test "Transfer Appropriate Processing." They noted that students often do not appropriately adjust their strategies. Students should know what the format of the test will be, and use any available practice tests to guide them in their study strategy selection. When memory is the focus, repeatedly going over the material would be appropriate. However, when application or analyses are called for, more elaborative strategies will be required to be adequately prepared.

   In the distance learning setting, students work more independently. They do not have peer interaction that might aid them in selecting appropriate test preparation study strategies. It is especially important for distance learners to be self-regulated students who are metacognitively aware, possess various study skills, and are prepared to select the study strategy that best corresponds to the test demands.

6. References:
Dembo, M. (2000). *Motivation and learning strategies for college success*. Mahwah, NJ: Erlbaum.

Fleming, V. M. (2002). Improving students' exam performance by introducing study strategies and goal setting. *Teaching of Psychology, 29*, 115-119.

Kitsantas, A. (2002). Test preparation and performance: A self-regulatory analysis. *Journal of Experimental Education, 70*, 101-113.

Morris, L. W., Bransford, J. D., & Franks, J. J. (1977). Levels of processing versus transfer appropriate processing. *Journal of Verbal Learning and Verbal Behavior, 16*, 519-533.

Nist, S. L., Simpson, M. L., & Hogrebe, M. C. (1985). The relationship between the use of study strategies and test performance. *Journal of Reading Behavior, 17*, 15-28.

Pressley, M., Yokoi, L., van Meter, P., Van Etten, S., & Freebern, G. (1997). Some of the reasons preparing for exams is so hard: What can be done to make it easier? *Educational Psychology Review, 9*, 1-38.

Zimmerman, B. J. (1998). Academic studying and the development of personal skill: A self-regulatory perspective. *Educational Psychologist, 33*(2/3), 73-86.

7. Glossary:

Cognition: The role of the learner's mental processing of information (Dembo, 2000).

Learning strategies: The techniques or methods students use to acquire information (Dembo, 2000).

Metacognition: The knowledge of one's own thinking processes and ability to regulate these processes (Dembo, 2000).

Self-regulated learning: Learning that occurs primarily from the influence of students' self-generated thoughts, feelings, strategies, and behaviors, which are oriented toward the attainment of goals (Zimmerman, 1998).

8. User: Instructional designer

9. ID: Myron H. Dembo and Linda Gubler Junge, *What Works in Distance Learning: Learning Strategies,* Strategies Based on Test Preparation, v.5, updated last on 02/21/03. See also O'Neil, H. F. (2003). *What works in distance learning* (Report to the Office of Naval Research). Los Angeles: University of Southern California, Rossier School of Education. Available at [URL to be added]

Strategies Based on Help Seeking
(Dembo and Gubler Junge, v.5, 02/21/03)

1. Guideline (nontechnical):	Active learners who are motivated to achieve tend to seek help when it is needed.
2. Guideline (technical)	If students are mastery oriented and have positive perceptions of their ability to achieve, then they are likely to seek help from social (i.e., teachers or classmates) and/or nonsocial sources (i.e., written sources) when faced with complex and/or difficult tasks.
3. Guidelines based on	Research
4. Degree of confidence	Moderate
5. Comments:	One of the distinguishing characteristics of self-regulated learners is their ability to seek academic assistance in an adaptive manner to optimize learning. Research suggests that the students who need help the most are generally the least likely to ask for it (Newman, 1994). The importance of the social context in distance learning has been widely discussed (Hara & Kling, 2000; Major & Levenberg, 1999). The social context of learning refers to both collaboration with and feedback from online classmates and instructors, as well as the learner's ability to identify nonsocial resources (e.g., supplementary instructional materials). Distance learners must be able to determine where and how to seek help, and make decisions concerning the most appropriate sources for such help.
6. References:	Hara, N., & Kling, R. (2000). *Students' distress with a Web-based distance education course* (CSI Working Paper). Indiana University, Center for Social Informatics. Retrieved [date] from http://www.slis.indiana.edu/CSI/wp00-01.htm Karabenick, S. A., & Knapp, J. R. (1991). Relationship of academic help seeking to the use of learning strategies and other instrumental achievement behavior in college students. *Journal of Educational Psychology, 83*, 221-230. Major, H., & Levenberg, N. (1999). *Learner success in distance education environments: a shared responsibility. Commentary.* [On-line]. Retrieved [date] from http://horizon.unc.edu/TS/commentary/1999-01.asp

Newman, R. S. (1994). Adaptive help seeking: A strategy of self-regulated learning. In D. Schunk & B. Zimmerman (Eds.), *Self-regulation of learning and performance: Issues and educational applications* (pp. 283-301). Hillsdale, NJ: Erlbaum.

Ryan, A. M., & Pintrich, P. R. (1998), Achievement and social motivational influences on help seeking in the classroom. In S. A. Karabenick (Ed.), *Strategic help seeking: Implications for learning and teaching* (pp. 117- 139). Mahwah, NJ: Erlbaum.

Ryan, A., Pintrich, P., & Midgley, C. (2001). Avoiding seeking help in the classroom: Who and why? *Educational Psychology Review, 13*, 93-114.

Zimmerman, B. J. (1998). Academic studying and the development of personal skill: A self-regulatory perspective. *Educational Psychologist, 33*, 73-86.

7. Glossary:

Self-regulatory process of help seeking: The process of choosing specific models, teachers, or books to assist oneself to learn (Zimmerman, 1998).

Adaptive help-seeking: Used by self-regulatory learners to confront difficulties by persisting until they recognize additional effort would be unproductive, and seek help in ways that not only allow them to succeed but help them become more autonomous learners (Karabenick & Knapp, 1991).

Goal orientation: A specific belief regarding the purpose and meaning that a learner ascribes to achievement behavior. In a mastery or learning orientation, the learner desires to master the content and believes that effort plays a major role toward achieving this goal. In a performance or ability orientation, the learner is concerned with outperforming others and is motivated to avoid failure (Ryan, Pintrich, & Midgley, 2001).

8. User: Instructional designer

9. ID: Myron H. Dembo and Linda Gubler Junge, *What Works in Distance Learning: Learning Strategies,* Strategies Based on Help Seeking, v.5, updated last on 02/21/03. See also O'Neil, H. F. (2003). *What works in distance learning* (Report to the Office of Naval Research). Los Angeles: University of Southern California, Rossier School of Education. Available at [URL to be added]

Strategies Based on Time Management
(Dembo and Gubler Junge, v.5, 02/21/03)

1. Guideline (nontechnical): Students who use their time efficiently are more likely to learn and/or perform more successfully than students who do not have good time management skills.

2. Guideline (technical): If students use their time more efficiently, then they are more likely to improve their learning and performance.

3. Guideline based on: Research

4. Degree of confidence: Moderate

5. Comments: Successful students know how to manage their time in order to learn and accomplish necessary tasks. Self-regulated students know how to manage their time because they are aware of deadlines, how long it will take to complete each assignment, and their own learning processes. The greater such awareness is, the better the time management skills will be, meaning that more material will be read, reviewed, and elaborated upon (Zimmerman & Greenberg, 1994; Zimmerman & Martinez-Pons, 1986). In this way, time management improves achievement. Britton and Tesser (1991) suggested that time management measures are more predictive of academic achievement level than is the SAT score. One reason that self-regulated students with good time management skills may achieve so much academically could be because they tend to spend more time on difficult items than easier ones (Le Ny, Denhiere, & Le Taillanter, 1972). Time management skills can be learned, and subsequent efforts by students to manage their study time do make a difference academically. As time management skills are refined, more time is spent on task, procrastination decreases, tasks are completed on time, and chances of academic achievement and success improve. Additionally, as use of time improves, individuals show increased intrinsic interest and enhanced personal perceptions (Hall & Hursch, 1981-82).

In a distance-learning setting, goal-setting, planning, and time management are often the sole responsibility of the student, who has little or no interaction with other students or the instructor. In order to successfully complete all assignments and acquire the necessary information, students in such settings will need to be able to pace themselves, using time management skills to distribute learning and complete assigned work over time.

6. References:

Britton, B. K., & Tesser, A. (1991). Effects of time management practices on college grades. *Journal of Educational Psychology, 83*, 405-410.

Hall, B. L., & Hursch, D. E. (1981-82). An evaluation of the effects of a time management training program on work efficiency. *Journal of Organizational Behavior Management, 3*(4), 73-96.

Le Ny, J. F., Denhiere, G., & Le Taillanter, D. (1972). Regulation of study-time and interstimulus similarity in self-paced learning conditions. *Acta Psychologica, 36*, 280-289.

Zimmerman, B. J. (1998). Academic studying and the development of personal skill: A self-regulatory perspective. *Educational Psychologist, 33*(2/3), 73-86.

Zimmerman, B. J., & Greenberg, D. (1994). Self-regulating academic study time: A strategy approach. In D. H. Schunk & B. J. Zimmerman (Eds.), *Self-regulation of learning and performance: issues and educational applications*, (pp. 181-199). Hillsdale, NJ: Erlbaum.

Zimmerman, B. J., & Martinez-Pons, M. (1986). Development of a structured interview for assessing student use of self-regulated learning strategies. *American Educational Research Journal, 23*, 614-628.

7. Glossary:

Time management: The ability to accurately assess the time required to complete a given task, plan accordingly to appropriate the needed time, and successfully complete the task (Zimmerman & Greenberg, 1994).

8. User:

Instructional designer

9. ID:

Myron H. Dembo and Linda Gubler Junge, *What Works in Distance Learning: Learning Strategies,* Strategies Based on Time Management, v.5, updated last on 02/21/03. See also O'Neil, H. F. (2003). *What works in distance learning* (Report to the Office of Naval Research). Los Angeles: University of Southern California, Rossier School of Education. Available at [URL to be added]

Strategies Based on Goal Setting
(Dembo and Gubler Junge, v.5, 02/21/03)

1. Guideline (nontechnical): Students with specific, challenging goals outperform those with general, easy, or no goals.

2. Guideline (technical): If students have specific, challenging goals then academic performance is enhanced through directed attention, increased effort, and persistence.

3. Guideline based on: Research

4. Degree of confidence: High

5. Comments: There are many academic benefits to goal setting. Goals direct attention, mobilize effort, increase persistence, and motivate strategy development. As students select and pursue goals, they are able to progress personally, gain feedback, and self-monitor their progress. They become more self-motivated. Students with specific, challenging goals outperform those with general, easy, or no goals. Effective goals are short term (current) and so ask learners to accomplish specific tasks today or, at the most, this week (longer term goals do not necessarily help performance). It is important that students have the ability to attain or at least approach the specific, challenging goal; it cannot be out of reach and unrealistic for the academic benefits to accrue (Locke & Latham, 2002).

In a distance learning setting, self-selected goals can give the student a sense of control, as well as structure. There is little or no interaction with an instructor, and the pace at which material is covered will depend almost entirely on the individual student. In order to set and maintain an appropriate pace, goal setting and self-monitoring must occur. The material to be covered must be broken down into monthly and weekly goals. Daily tasks and schedules need to be set up, adhered to, evaluated, reevaluated, and adjusted as necessary.

Except for highly novel and complex tasks (Kanfer, Ackerman, Murta, Dugdale, & Nelson, 1994), “Three C” goals (Concrete, Current and Challenging) seem to help both learning and motivation. On the motivation side, Locke and Latham (2002) suggested that specific Three C goals facilitate active choice by encouraging ‘‘relevant’’ activities for goal achievement; they encourage appropriate mental effort, since adults need to adjust

their effort to the level of the goal and people tend to persist in the face of distractions until they attain their goals.

6. References:

Curry, J., Haderlie, S., Ku, T., Lawless, K., Lemon, M., & Wood, R. (1999). Specified learning goals and their effect on learners' representations of a hypertext reading environment. *International Journal of Instructional Media, 26*, 43-51.

Dembo, M. (2000). *Motivation and learning strategies for college success*. Mahwah, NJ: Erlbaum.

Fleming, V. M. (2002). Improving students' exam performance by introducing study strategies and goal setting. *Teaching of Psychology, 29*, 115-119.

Kanfer, R., Ackerman, P. L., Murta, P. C., Dugdale, P., & Nelson, L. (1994). Goal setting, conditions of practice and task performance: A resource allocation perspective. *Journal of Applied Psychology, 79,* 826-835.

Locke, E. A., & Latham, G. P. (2002). Building a practically useful theory of goal setting and task motivation. *American Psychologist*, *57,* 705-717.

Zimmerman, B. J., & Kitsantas, A. (1997). Developmental phases in self-regulation: shifting from process to outcome goals. *Journal of Educational Psychology, 89*, 29-36.

7. Glossary:

Attention: A selective process that controls awareness of events in the environment (Dembo, 2000).

Goal setting: The process of setting a course to attain a specific desired end by articulating subtasks and setting timelines for completion (Locke & Latham, 2002).

8. User: Instructional designer

9. ID: Myron H. Dembo and Linda Gubler Junge, *What Works in Distance Learning: Learning Strategies,* Strategies Based on Goal Setting, v.5, updated last on 02/21/03. See also O'Neil, H. F. (2003). *What works in distance learning* (Report to the Office of Naval Research). Los Angeles: University of Southern California, Rossier School of Education. Available at [URL to be added]

Strategies Based on Test Anxiety Reduction
(Dembo and Gubler Junge, v.5, 02/21/03)

1. Guideline (nontechnical): Students' test anxiety can be reduced and, often, test performance increased by using a variety of educational interventions.

2. Guideline (technical): If students participate in a variety of test anxiety interventions, they can reduce their test anxiety and often improve their test performance.

3. Guidelines based on: Research

4. Degree of confidence: Moderate

5. Comments: Test anxiety is a specific form of anxiety about academic and ability evaluations that can negatively influence students' motivation and academic performance. Test anxiety is a common problem, particularly among adult learners who are concerned about their ability to meet expectations and have a fear of failure. Anxiety can impact students at two major stages—studying and test taking. While studying, some students think about lack of ability, poor expectations, and the futility and ineffectiveness of their study. Anxiety interferes with appropriate organization of the content materials at this point. Students threatened by failure may also become involved in avoidance behaviors, such as irrational goal setting or procrastination, that will further erode their study effectiveness. In the test-taking stage, students attempt to retrieve what they have learned, sometimes in the face of great physical tension and worry. Anxiety at this stage interferes with the retrieval of information.

The most effective educational interventions used to treat test anxiety include cognitive-behavioral treatments such as relaxation techniques, provision of appropriate modeling of positive and negative self-talk, and practice of such skills in a testing environment (Hembree, 1988). It is important to analyze in which of the stages anxiety is occurring. Does the student have poor study skills? If so, some skill training in learning strategies will be required. If the student has good study skills, then a cognitive modification program aimed at test taking would be effective.

6. References:

Awang-Hashim, R., O'Neil, H. F., & Hocevar, D. (in press). Ethnicity, effort, self-efficacy, worry, and statistics in Malaysia: A construct validation of the state-trait motivation model. *Educational Assessment*.

Collins, L. (1999). Effective strategies for dealing with test anxiety: teacher to teacher. *U.S. Dept. of Education, Office of Educational Research and Improvement, Educational Resources Information Center*. (ERIC Document Reproduction Service No. ED426214)

Hembree, R. (1988). Correlates, causes, effects, and treatment of test anxiety. *Review of Educational Research, 58*, 47-77.

Liebert, R., & Morris, L. (1967). Cognitive and emotional components of test anxiety: A distinction and some initial data. *Psychological Report, 20*, 975-978.

Zeidner, M. (1998). Coping with test situations: resources, strategies, and adaptational outcomes. *Test anxiety: the state of the art* (pp. 305-331). New York: Plenum Press.

7. Glossary:

Test anxiety: Debilitating personal outcomes when a person is required to take some assessment of his or her competency. It consists of two components—worry and emotionality. Worry is the cognitive expression of concern about one's own performance, and emotionality refers to physiological reactions to the test situation (Liebert & Morris, 1967).

Relaxation training: Involves a variety of interventions that include methods of breath control training and muscle relaxation. Tapes of soft music or calming sounds (e.g., a waterfall or birds) are often used in the training.

8. User: Instructional designer

9. ID: Myron H. Dembo and Linda Gubler Junge, *What Works in Distance Learning: Learning Strategies,* Strategies Based on Test Anxiety Reduction, v.5, updated last on 02/21/03. See also O'Neil, H. F. (2003). *What works in distance learning* (Report to the Office of Naval Research). Los Angeles: University of Southern California, Rossier School of Education. Available at [URL to be added]

CHAPTER 5

WHAT WORKS IN DISTANCE LEARNING: ASSESSMENT STRATEGIES

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The following guidelines are presented in this chapter.

1. Validity Strategies
2. Cognitive Demands Strategies
3. Domain Representation Strategies
4. Test Specifications Strategies
5. Scoring Strategies
6. Reliability Strategies
7. Reporting Strategies
8. Formative Assessment Strategies
9. Certification Tests: Cut Score Strategies
10. Formative Evaluation Strategies
11. Summative Evaluation Strategies

Validity Strategies
(Baker, Aguirre-Muñoz, Wang, & Niemi, v.9, 02/21/03)

1. Guideline (nontechnical): Validity is the degree to which appropriate inferences, conclusions, or decisions can be made from test results and depends fundamentally on the purpose for which the test is being used.

2. Guideline (technical): Validity is established by describing the purpose of the test and then creating a logical and/or empirically based argument that supports the use of the findings for the intended purposes.

3. Guidelines based on: Theory and research

4. Degree of confidence: High

5. Comments: Validity refers to the degree to which empirical evidence and theory support the adequacy and appropriateness of interpretations, and subsequent actions, based on test scores (Messick, 1995a). The procedure for validation involves finding evidence that will support or disconfirm the interpretations to be made from test scores. Over time, available validity evidence is augmented by new empirical findings, perhaps involving similar settings or examinees. The closer the match of the situation, examinees, and purposes, the more likely the empirical information will be useful, because validity is specific to the examinee group, context, and purpose of the assessment. It can only be investigated when examination conditions are known and standardized.

Although validity had been divided into subtypes (i.e., content, predictive, criterion, or construct), newer thinking emphasizes that validity is a unified idea related to the appropriateness of the interpretation and may use a wide range of evidence to form the conclusion. Validity depends on how the test is used rather than details of the test properties.

Four essential elements are required for a test to be valid. First, the test items must be within the boundaries of the domain to be assessed (Messick, 1995b). Second, the items must fully represent the domain being assessed (Messick, 1995a, 1995b). This ensures that the data gathered accurately reflect the important components of the domain being assessed. Items might be selected in terms of what characterizes and differentiates expertise in a particular area. Third, the items must not give credit to performance that is not relevant to the domain being tested. Last, validity implies fairness to identifiable subgroups of examinees. Fairness issues to consider are fair access to the test and fair administration, opportunity to

learn the tested domain, equitable treatment for all examinees, and bias related to examinees' background factors.

6. References:

American Educational Research Association, American Psychological Association, & National Council on Measurement in Education. (1999). *Standards for educational and psychological testing*. Washington, DC: American Educational Research Association.

Messick, S. (1989). Validity. In R. L. Linn (Ed.), *Educational measurement* (3rd ed., pp. 13-103). New York: Macmillan.

Messick, S. (1995a). Standards of validity and the validity of standards in performance assessment. *Educational Measurement: Issues and Practice, 14*(4), 5-8.

Messick, S. (1995b). Validity of psychological assessment: Validation of inferences from persons' responses and performances as scientific inquiry into score meaning. *American Psychologist, 50,* 741-749.

Glossary**:**

Construct validity: "[I]s evaluated by investigating what qualities a test measures, that is, by determining the degree to which certain explanatory concepts or constructs account for performance on the test" (Messick, 1989, p. 16).

Content validity: "[I]s evaluated by showing how well the content of the test samples the class of situations or subject matter about which conclusions are to be drawn (Messick, 1989, p. 16).

Criterion-related validity: "[I]s evaluated by comparing the test scores with one or more external variables (called criteria) considered to provide a direct measure of the characteristics or behavior in question (Messick, 1989, p. 16).

Predictive validity: "[I]ndicates the extent to which an individual's future level on the criterion is predicted from prior test performance (Messick, 1989, p. 16).

8. User: Program manager, assessment designer

9. ID: Eva Baker, Zenaida Aguirre-Muñoz, Jia Wang, and David Niemi, *What Works in Distance Learning: Assessment Strategies,* Validity Strategies, v.9, updated last on 02/21/03. See also O'Neil, H. F. (2003). *What works in distance learning* (Report to the Office of Naval Research). Los Angeles: University of Southern California, Rossier School of Education. Available at [URL to be added]

Cognitive Demands Strategies
(Baker, Aguirre-Muñoz, Wang, & Niemi, v.9, 02/21/03)

1. Guideline (nontechnical):	Assessment specifications should explicitly reference both the models of cognitive demand in the task, (e.g., knowledge understanding or problem solving) and the cognitive requirements of desired performance in the specific content area.
2. Guideline (technical):	To ensure that assessments reflect the types of learning to be assessed, assessment design and validation should be preceded by a cognitive analysis of the task/performance, divided into aspects that are domain independent and those specially addressed to the domain of learning and assessment.
3. Guidelines based on:	Research and expert opinion
4. Degree of confidence:	High
5. Comments:	Assessment development should have a scientific basis; e.g., specification of the domain to be assessed should draw on cognitive research in the domain, and task design should be informed by cognitive analysis and empirical testing of tasks. Both domain-independent and domain-specific cognitive demands should be analyzed. Model-based assessment design is an approach to the development and validation of assessments based on the cognitive demands of the task nested within a particular content area, and the application of domain-independent specifications that serve as templates for the creation of assessments comparable across different topic or content areas. Performances can be analyzed initially in terms of five families of domain-independent cognitive demands (Baker, 1997): content understanding, problem solving, metacognition, communication, and teamwork.
6. References:	American Educational Research Association, American Psychological Association, & National Council on Measurement in Education. (1999). *Standards for educational and psychological testing*. Washington, DC: American Educational Research Association. Baker, E. L. (1997). Model-based performance assessment. *Theory Into Practice, 36*, 247-254. Hsieh, I.-L. G., & O 'Neil Jr., H. F. (2002). Types of feedback in a computer-based collaborative problem-solving group task. *Computers in Human Behavior, 18*, 699-715.

Niemi, D. (1997). Cognitive science, expert-novice research, and performance assessment. *Theory Into Practice, 36,* 239-246.

7. Glossary:

Cognitive demands: To analyze the "cognitive demands" of a performance means to specify the knowledge and mental skills required to complete that performance successfully.

Communication: Representation of information to another person (Baker, 1997). Modes of communication include speech, gesture, text, and graphical representations (e.g., pictures, diagrams, graphs).

Content knowledge: Knowledge in a specific subject area, including (a) core principles and concepts, (b) factual knowledge, (c) procedures for solving problems in the subject area, (d) knowledge about when and how to use subject area knowledge, and (e) knowledge about how new information in the subject area is developed, justified, and evaluated (Niemi, 1997).

Domain-independent cognitive demands: Refers to tasks, such as problem solving, whose formal structure transfers among different subject matter, for example, damage control, troubleshooting.

Metacognition: Planning and monitoring one's progress toward solving a problem (Hsieh & O'Neil, 2002).

Problem solving: Cognitive processing directed at achieving a goal when no solution method is obvious to the problem solver (Hsieh & O'Neil, 2002).

Teamwork: Refers to work on tasks in which members of the group must interact with others in order to accomplish the task (Hsieh & O'Neil, 2002).

8. User: Assessment designer, program manager

9. ID: Eva Baker, Zenaida Aguirre-Muñoz, Jia Wang, and David Niemi, *What Works in Distance Learning: Assessment Strategies,* Cognitive Demands Strategies, v.9, updated last on 02/21/03. See also O'Neil, H. F. (2003). *What works in distance learning* (Report to the Office of Naval Research). Los Angeles: University of Southern California, Rossier School of Education. Available at [URL to be added]

Domain Representation Strategies

(Baker, Aguirre-Muñoz, Wang, & Niemi, v.9, 02/21/03)

1. Guideline (nontechnical): Tests must contain adequate sampling of items or tasks that are representative of the content domain to be assessed.

2. Guideline (technical): Validity investigations should examine and describe the degree to which content on tests is relevant to and representative of the domain assessed, particularly to avoid construct underrepresentation.

3. Guidelines based on: Research and expert opinion

4. Degree of confidence: High

5. Comments: Content representation can be best determined by experts in the content domain who match test specifications and test item features. Their task is to identify gaps, overrepresentation, and content errors, and to assure that the administration of the test itself provides adequate stimuli. Individual items should be judged for their relevance to the content domain and the collection of items evaluated for representativeness of the domain of competency to be tested. The test should capture all important parts of the domain, content as well as processes (i.e., what people actually do in the performance domain), including characteristics that distinguish expert knowledge and skill.

Review of scoring criteria should be part of this process for open-ended tasks, augmented by the presentation of exemplars of work at different proficiency levels. Degree of agreement among raters should be reported. A related concern is the inclusion of items or tasks that are too broad and that inadvertently assess knowledge or skills not outlined in the test specifications. Such items would introduce construct-irrelevant variance—another major threat to validity.

6. References:

American Educational Research Association, American Psychological Association, & National Council on Measurement in Education. (1999). *Standards for educational and psychological testing*. Washington, DC: American Educational Research Association.

Linn, R. L., Baker, E. L., & Dunbar, S. B. (1991). Complex, performance assessment: Expectations and validation criteria. *Educational Researcher, 20*(8), 15-21.

Messick, S. (1996). Validity of performance assessment. In G. Phillips (Ed.), *Technical issues in large-scale performance assessment* (pp. 1-18). Washington, DC: U.S. Department of Education, National Center for Education Statistics.

7. Glossary:

Construct-irrelevant variance: Occurs when an assessment task includes skills not included in the domain, requiring abilities for successful completion of the test that are not explicit goals of instruction. An example of construct-irrelevant variance is difficult language used in test items or a task that incorporates complex linguistic structures when its intent is to measure knowledge of a particular technical system (Messick, 1996).

Construct underrepresentation: Occurs when an assessment is too narrow, missing important facets of the overall content domain and the constructs of which the domain is comprised (Messick, 1996).

8. User: Assessment designer

9. ID: Eva Baker, Zenaida Aguirre-Muñoz, Jia Wang, and David Niemi, *What Works in Distance Learning: Assessment Strategies,* Domain Representation Strategies, v.9, updated last on 02/21/03. See also O'Neil, H. F. (2003). *What works in distance learning* (Report to the Office of Naval Research). Los Angeles: University of Southern California, Rossier School of Education. Available at [URL to be added]

Test Specifications Strategies

(Baker, Aguirre-Muñoz, Wang, & Niemi, v.9, 02/21/03)

1. Guideline (nontechnical):	Prior to item, test, or task development, test specifications should be prepared to guide the test designers' attention to key elements of the test such as test purposes, intellectual skills, content, and format of the test.
2. Guideline (technical):	In order to constrain the types of items developed, test specifications should be prepared that detail the intended use of results, the boundaries of content knowledge, cognitive demands of performance, and situations on the test, as well as response formats, sample items, scoring procedures, composition of the entire test, test administration procedures, and the intended population of test takers.
3. Guidelines based on:	Research and expert opinion
4. Degree of confidence:	High
5. Comments:	Test specifications refer to the test framework containing information about the format of items, tasks, or questions; the response format or conditions for responding; and the type of scoring procedures. Test specifications may also include information regarding the desired psychometric properties of the items, such as difficulty and discrimination, as well as the desired test properties such as test difficulty and reliability. All subsequent test development activities are guided by the test specifications. The first step in generating test specifications is to have clearly in mind the respondents and the purpose or purposes for which the results will be used. The three common purposes are to support instruction, to provide individual or team certification, and to provide data for use in program evaluation. Test specifications need to be reviewed for clarity and compared to the intended goals of the training system, and to any specific goals for transferring or applying knowledge to new domains or situations. Also, test specifications need to be reviewed to assure that the test fully represents the range of knowledge required. The major usefulness of specifications comes in the review of the match among individual items, curriculum, and test specifications. This review requires that a judgment be made of the balance among content areas, avoiding construct underrepresentation. However, overrepresentation may be needed for important or especially difficult tasks. In addition to providing evidence that the

	individual items and the test as a whole are measuring the targeted cognitive and content domains, specifications may yield sufficient items to provide stable measures of subskills or objectives. Specifications should demand detailed information about the intended examinee group and sample test items, scoring schemes, and reporting plans.
6. References:	American Educational Research Association, American Psychological Association, & National Council on Measurement in Education. (1999). *Standards for educational and psychological testing*. Washington, DC: American Educational Research Association. Baker, E. L., Freeman, M., & Clayton, S. (1991). Cognitive assessment of history for large scale testing. In Wittrock & E. L. Baker (Eds.), *Testing and cognition* (pp. 131-153). Englewood Cliffs, NJ: Prentice-Hall. Messick, S. (1995). Standards of validity and the validity of standards in performance assessment. *Educational Measurement: Issues and Practice, 14*(4), 5-8.
7. Glossary:	*Construct underrepresentation:* Occurs when an assessment is too narrow, missing important facets of the overall content domain and the constructs of which the domain is comprised (Messick, 1995). *Content domain:* Refers to the process of delineating the boundaries of the construct(s) to be assessed and expressed through current models of learning and instruction. This process involves identifying and clarifying the specific knowledge, skills, related mental processes, additional attributes, and/or attitudes that should be assessed (Baker, Freeman, & Clayton, 1991).
8. User:	Assessment and instructional designers
9. ID:	Eva Baker, Zenaida Aguirre-Muñoz, Jia Wang, and David Niemi, *What Works in Distance Learning: Assessment Strategies*, Test Specifications Strategies, v.9, updated last on 02/21/03. See also O'Neil, H. F. (2003). *What works in distance learning* (Report to the Office of Naval Research). Los Angeles: University of Southern California, Rossier School of Education. Available at [URL to be added]

Scoring Strategies

(Baker, Aguirre-Muñoz, Wang, & Niemi, v.9, 02/21/03)

1. Guideline (nontechnical):	A scoring framework should include information on the measurement scale, scoring criteria, performance descriptions of each criterion at each point on the scale, and sample responses that illustrate the various levels of performance.
2. Guideline (technical):	Scoring criteria must be identified and empirically verified, the reporting scale developed, and training designed and developed as needed for scorers or raters.
3. Guidelines based on:	Theory and research
4. Degree of confidence:	High
5. Comments:	Different scoring frameworks should be followed for choice-response assessment and performance-based assessment. With choice-response assessment, the scoring procedure consists of (a) specifying the answer key for each item, (b) a rule for adding up the scores, and (c) the actual scoring of the assessment. The scoring, typically done by machines, is fast, economical, and relatively free of scoring error. The one major disadvantage is that choice-response assessment is susceptible to guessing and decontextualizes knowledge assessment. Performance-based assessment (e.g., essay items or simulations) requires examinees to construct their own responses to questions or prompts. The assessment imitates or creates the real context in which the examinees can demonstrate their knowledge and skills. Performance-based assessment requires human judgment. The scoring is usually done by raters and requires careful selection of raters and detailed design and administration of training and scoring sessions. The typical scoring process includes the preparation of a scoring rubric for each task, the preparation of training and qualifying packets consisting of actual responses, rater training and calibrating, scoring, and monitoring of raters' work. Assignment of work to be rated should be at random to avoid rater bias. Alternative techniques for scoring performance-based assessments are holistic scoring and analytic scoring. Because it includes scores for multiple dimensions, analytic scoring is usually preferred for providing useful information to improve instruction. Holistic scoring is preferred when an overall evaluation is needed.
6. References:	American Educational Research Association, American Psychological Association, & National Council on Measurement in Education. (1999). *Standards for educational and psychological testing*. Washington, DC: American Educational Research Association.

Arter, J., & McTighe, J. (2001). *Scoring rubrics in the classroom: Using performance criteria for assessing and improving student performance*. Thousand Oaks, CA: Corwin Press.

Haladyna, T. M., Downing, S. M., & Rodriguez, M. C. (2002). A review of multiple-choice item-writing guidelines for classroom assessment. *Applied Measurement in Education, 15,* 309-334.

Herman, J., Aschbacher, P., & Winters, L. (1992). *A practical guide to alternative assessment*. Alexandria, VA: Association for Supervision and Curriculum Development.

Messick, S. (1989). Validity. In R. L. Linn (Ed.), *Educational measurement* (3rd ed., pp. 13-103). New York: Macmillan.

Millman, J., & Greene, J. (1989). The specification and development of tests of achievement and ability. In R. L. Linn (Ed.), *Educational measurement* (3rd ed., pp. 335-366). New York: Macmillan.

7. Glossary:

Analytic scoring: Evaluates examinee's work across multiple dimensions of performance. Individual scores for each dimension are reported (Arter & McTighe, 2001).

Choice-response assessment: Requires examinees to select the correct response from two or more alternatives (e.g., multiple-choice, true or false, or matching test items) (Millman & Greene, 1989).

Score: A score indicates one's performance level. To understand a score, one needs information on the associated task and the performance of others (Messick, 1989).

Scoring rubric: The rubric contains the criteria for evaluating performance and may vary in the degree of judgment, scoring scale, and others (Arter & McTighe, 2001).

8. User: Assessment designer; program manager

9. ID: Eva Baker, Zenaida Aguirre-Muñoz, Jia Wang, and David Niemi, *What Works in Distance Learning: Assessment Strategies,* Scoring Strategies, v.9, updated last on 02/21/03. See also O'Neil, H. F. (2003). *What works in distance learning* (Report to the Office of Naval Research). Los Angeles: University of Southern California, Rossier School of Education. Available at [URL to be added]

Reliability Strategies

(Baker, Aguirre-Muñoz, Wang, & Niemi, v.9, 02/21/03)

1. Guideline (nontechnical):	A reliable test should give accurate and similar scores from one occasion to another, from one form of a test to another, and from one rater to another.
2. Guideline (technical):	Traditionally, the reliability of a measure is defined as its consistency in giving the same results for the same person over time. More recently, reliability is thought to consist of both accuracy and consistency. There are two testing theories that provide reliability indices: classical true-score theory and generalizability (G) theory.
3. Guidelines based on:	Theory and research
4. Degree of confidence:	High
5. Comments:	The fundamental assumption of the classical true-score theory is that the score of an examinee consists of two parts: true score and error of measurement. There are mainly three methods associated with estimating a reliability coefficient: test/retest, parallel forms, and internal consistency. Cronbach's alpha coefficient is one of the most frequently used internal consistency measures. Dependability of behavioral measurements is the focus of generalizability (G) theory. Dependability refers to the accuracy of generalizing a person's observed score on one test to his/her average score across all possible testing conditions. G theory goes beyond the classical true-score theory by estimating multiple sources of error in a measurement simultaneously in a single analysis. For example, if we give two forms of a test, on two different occasions, scored by five raters, the error of measurement would come from all three sources (i.e., forms, occasions, and raters), their interactions, and from unknown residual sources. G theory provides a G coefficient to indicate the dependability level of a score and allows a design aspect that suggests how many test forms, raters, etc. are needed in order to have dependable scores. Research has documented that it is easier to obtain high degrees of rater agreement (with proper training) and more difficult to find high relationships for performance across tasks.
6. References:	American Educational Research Association, American Psychological Association, & National Council on Measurement in Education. (1999). *Standards for educational and psychological*

testing. Washington, DC: American Educational Research Association.

Brennan, R. L. (2000). Performance assessments from the perspective of generalizability theory. *Applied Psychological Measurement, 24*, 339-353.

Linn, R. L. (Ed.). (1989). *Educational measurement* (3rd ed.). New York: Macmillan.

Moss, P. (1994). Can there be validity without reliability? *Educational Researcher, 23*(2), 5-12.

Webb, N. M., Shavelson, R. J., Kim, K.-S., & Chen, Z. (1989). Reliability (generalizability) of job performance measurements: Navy Machinist Mates. *Military Psychology, 1,* 91-110.

7. Glossary:

Accuracy: Refers to the degree that the test scores are free from measurement error (Moss, 1994).

Consistency: Refers to the extent a measure yields identical results from independent but interchangeable observations (Moss, 1994).

Cronbach's alpha coefficient: A measure of internal consistency.

Parallel forms reliability coefficient: Is a correlation coefficient between observed scores from different forms of a test in which the forms are parallel to each other in all aspects except specific test items (Webb, Shavelson, Kim, & Chen, 1989).

Test-retest reliability coefficient: Is a correlation coefficient between observed scores from one test occasion to another (Webb, Shavelson, Kim, & Chen, 1989).

True score: The average score across multiple independent administrations of the same test, which minimizes the measurement error.

8. User: Evaluator and assessment developer

9. ID: Eva Baker, Zenaida Aguirre-Muñoz, Jia Wang, and David Niemi, *What Works in Distance Learning: Assessment Strategies,* Reliability Strategies, v.9, updated last on 02/21/03. See also O'Neil, H. F. (2003). *What works in distance learning* (Report to the Office of Naval Research). Los Angeles: University of Southern California, Rossier School of Education. Available at [URL to be added]

Reporting Strategies

(Baker, Aguirre-Muñoz, Wang, & Niemi, v.9, 02/21/03)

1. Guideline (nontechnical):	Information on technical quality is needed including studies of reliability, appropriateness of the test for the particular content and user group, and validity interpretations of the results.
2. Guideline (technical):	Reporting of test results should include information on test purpose(s), test content, the scoring scheme, reporting scale, test validity, and test accuracy conveyed in nontechnical language.
3. Guidelines based on:	Research and expert opinion
4. Degree of confidence:	Medium
5. Comments:	Reporting should include comparisons such as performance in relation to particular goals, standards, or overall competency areas. Reports related to training are usually provided in terms of level of achievement attained (criterion referenced), but may be reported in terms of relative standing among a cohort or against an existing normative group (norm referenced), or may be reported in terms of individual or group progress. To judge the utility of the findings or standards, it is essential to report the magnitude of the measurement error and the level of accuracy given the examinee sample. Providing validity evidence on the link between a new assessment and existing measures increases the meaning and utility in terms of the test results. Attention must be paid to the appropriateness of the form of reporting for different audiences or stakeholders. Appropriate levels of technical language, graphs, and acceptable documentation of technical data will vary for different audiences. Periodic studies of report comprehension for their principal users will increase the utility of report findings
6. References:	American Educational Research Association, American Psychological Association, & National Council on Measurement in Education. (1999). *Standards for educational and psychological testing*. Washington, DC: American Educational Research Association. Burdette, P. (2001). Alternate assessment: Early highlights and pitfalls of reporting. *Assessment for Effective Intervention, 26*(2), 61-66.

Linn, R. L. (2000). Assessments and accountability. *Educational Researcher, 29*(2), 4-16.

7. Glossary:

Criterion-referenced test: Provides a measure of the examinees' absolute performance level, whether meeting certain criteria or not (American Educational Research Association, American Psychological Association, & National Council on Measurement in Education, 1999).

Norm: A norm for a test indicates the current status of examinee performance. It is constructed from a representative sample of examinees who have taken the same test (American Educational Research Association, American Psychological Association, & National Council on Measurement in Education, 1999).

Norm-referenced test: Compares an examinee's performance to the norm. The test results indicate the relative position of the examinees to the norm (American Educational Research Association, American Psychological Association, & National Council on Measurement in Education, 1999).

Scale: In testing, a scale is a composite measure of several items with built-in logical or empirical structure (American Educational Research Association, American Psychological Association, & National Council on Measurement in Education, 1999).

8. User: Program manager

9. ID: Eva Baker, Zenaida Aguirre-Muñoz, Jia Wang, and David Niemi, *What Works in Distance Learning: Assessment Strategies,* Reporting Strategies, v.9, updated last on 02/21/03. See also O'Neil, H. F. (2003). *What works in distance learning* (Report to the Office of Naval Research). Los Angeles: University of Southern California, Rossier School of Education. Available at [URL to be added]

Formative Assessment Strategies
(Baker, Aguirre-Muñoz, Wang, & Niemi, v.9, 02/21/03)

1. Guideline (nontechnical):	Tests given during instruction should provide information for feedback and motivation to the learner, guide the program to provide needed help, and give the instructional designer information about program strengths and weaknesses.
2. Guideline (technical):	Obtaining information through embedded or explicit performance trials will give information about the degree to which a learner is achieving in specified skills, subskills, and content domains. The patterns of success and misunderstandings inferred from performance errors can guide immediate intervention or recommendations for help and be used to revise subsequent versions of the instruction.
3. Guidelines based on:	Research and expert opinion
4. Degree of confidence:	High
5. Comments:	Sometimes called "formative assessment" or diagnostic testing, testing to support instruction is intended to help students learn from errors or to provide elaboration as a consequence of performance during instruction. (Black & Wiliam, 1998). One key point is that performance during instruction may follow different patterns that can predict desired outcomes. Obtaining such information is necessary but not sufficient to guarantee that performance will improve. Detailed feedback for the student may need to be supplemented by additional instructional experiences. Research supports the efficacy of providing detailed information for students about their responses, as well as advice on what they can do to improve. Students also benefit from training in self-assessment, which helps them understand the main goals of the instruction and determine what they need to do to master the content (Pellegrino, Chudowsky, & Glaser, 2001, pp. 177-259).
6. References:	Black, P., & Wiliam, D. (1998). Assessment and classroom learning. *Assessment in Education, 5*, 7-73. Kluger, A. N., & DeNisi, A. (1996). The effects of feedback intervention on performance: A historical review, a meta-analysis, and a preliminary feedback intervention theory. *Psychological Bulletin, 119,* 254-284**.** Pellegrino, J., Chudowsky, N., & Glaser, R. (Eds.). (2001). *Knowing what students know: The science and design of*

educational assessments (Committee on the Foundations of Assessment, Board on Testing and Assessment, Center for Education, Division on Behavioral and Social Sciences and Education, National Research Council). Washington, DC: National Academy Press.

7. Glossary:

Diagnostic testing: Provides information about the student's status and progress with respect to the acquisition and mastery of knowledge and skills, including learning strategies that can guide subsequent instruction.

Formative testing or assessment: Involves systematic acquisition of student achievement or performance information, often obtained by posing a problem or asking direct questions about responses. It requires considerable interaction with the learner. Diagnostic data result in detailed feedback based on assessment results focused on the qualities of the student's current understanding, including systematic errors and misconceptions due to lack of prior knowledge or errors in strategy; levels of competence; and depth of knowledge

8. User: Assessment and instructional designers

9. ID: Eva Baker, Zenaida Aguirre-Muñoz, Jia Wang, and David Niemi, *What Works in Distance Learning: Assessment Strategies,* Formative Assessment Strategies, v.9, updated last on 02/21/03. See also O'Neil, H. F. (2003). *What works in distance learning* (Report to the Office of Naval Research). Los Angeles: University of Southern California, Rossier School of Education. Available at [URL to be added]

Certification Tests: Cut Score Strategies

(Baker, Aguirre-Muñoz, Wang, & Niemi, v.9, 02/21/03)

1. Guideline (nontechnical):	The specification of the cut score of a certification test should be based on empirical studies that indicate accurate distinctions among levels of performance (for example, acceptable and unacceptable).
2. Guideline (technical):	The level of performance required for passing a certification test should depend on the knowledge and skills necessary for acceptable performance in the job it is intended to predict.
3. Guidelines based on:	Research and expert opinion
4. Degree of confidence:	High
5. Comments:	Tests for certification are designed to determine whether the core knowledge and skills of a specified domain have been mastered by the candidate. Therefore, prior to test development, a clear statement of the objectives of the test should be prepared, in additional to a clear definition of the content domain to be covered in terms of the importance of the content for performance deemed to be adequate for certification. Two potential objectives are to identify those individuals successfully completing training and those best suited for an intended job classification. Dividing examinees into various levels of success requires the identification of a passing or "cut" score. Arbitrary numerical specifications of cut scores, such as 70%, should be avoided because detailed information about the test, the job requirements, and their relationship is needed for setting adequate performance standards. A job or practice analysis provides the primary basis for defining the domain and the preliminary cut score and should be consistent with the objectives of the test and the level of feedback needed. This score cannot just be determined solely by expert judgment but needs to be empirically studied, using the tests with novices and with trained and expert performers. The validity of the inferences drawn from test performance depends on whether the cut score makes accurate distinctions between adequate and inadequate performance. If a test is not designed to provide information on how well an individual passed or how badly an individual failed, the test need only be precise around the vicinity of the cut score. However, when feedback is needed across the range of performance—about the degree of failure or success—precision throughout the score range is needed.

6. References:

American Educational Research Association, American Psychological Association, & National Council on Measurement in Education. (1999). *Standards for educational and psychological testing*. Washington, DC: American Educational Research Association.

Haertel, E. H. (1999). Validity arguments for high-stakes testing: In search of the evidence. *Educational Measurement: Issues and Practice, 18*(4), 5-9.

Jaeger, R. M. (1998). Evaluating the psychometric qualities of the National Board for Professional Teaching Standards' Assessments: A methodological accounting. *Journal of Personnel Evaluation in Education, 12,* 189-210.

7. Glossary:

Cut score: A specified point on a score scale, such that scores at or above that point are interpreted or acted upon differently from scores below that point (Jaeger, 1998).

8. User:

Assessment developer

9. ID:

Eva Baker, Zenaida Aguirre-Muñoz, Jia Wang, and David Niemi, *What Works in Distance Learning: Assessment Strategies,* Certification Tests: Cut Score Strategies, v.9, updated last on 02/21/03. See also O'Neil, H. F. (2003). *What works in distance learning* (Report to the Office of Naval Research). Los Angeles: University of Southern California, Rossier School of Education. Available at [URL to be added]

Formative Evaluation Strategies

(Baker, Aguirre-Muñoz, Wang, & Niemi, v.9, 02/21/03)

1. Guideline (non-technical): Formative evaluation provides information that focuses on improvement of an innovation and is designed to assist the developer.

2. Guideline (technical): Formative evaluation is a method that was created to assist in the development of instructional (training) programs. While the evaluation team maintains quasi objectivity, they typically interact with and understand program goals, processes, and constraints at a deeper level than evaluation teams focused exclusively on bottom-line assessments of success or failure (i.e., outcomes only, summative evaluation). Their intent is to assist their client (either funding agency or project staff) to use systematic data collection to promote the improvement of the effort.

3. Guidelines based on: Theory and research

4. Degree of confidence: High

5. Comments: Formative evaluation efforts are instituted at the outset of the development of an innovation and have a different purpose than summative evaluation. Formative evaluation addresses the effectiveness of the development procedures used, in order to predict whether the application of similar approaches is likely to have effective and efficient results. In that function, formative evaluation seeks both to improve the technology at large, as well as the specific instances addressed one at a time. The formative evaluation approach is designed so that its principal outputs are identification of the degree of success and failure of segments, components, and details of programs, rather than a simple, overall estimate of project success. This approach requires that data be developed to permit the isolation of elements for improvement and, ideally, the generation of remedial options to assure that subsequent revisions have a higher probability of success.

Formative evaluation is strong in identifying what to do if the new system is not an immediate, unqualified success. Given that this state is most common in early stages of development, comparative, summative-type evaluations are usually mis-timed and may create an unduly negative environment for productivity. Furthermore, because summative evaluation is typically not designed to pinpoint weaknesses and explore potential remedies, it provides almost no help in the development/improvement cycle that characterizes the systematic creation of new methods.

6. References:	Baker, E. L. (1974). Beyond objectives: Domain-referenced tests for evaluation and instructional improvement. In W. Hively (Ed.), *Domain-referenced testing* (pp. 16-30). Englewood Cliffs, NJ: Educational Technology Publications. Baker, E. L. (1988). Evaluating new technology: Formative evaluation of intelligent computer assisted instruction. In R. J. Seidel & P. D. Weddle (Eds.), *Computer based instruction in military environments* (pp. 155-162). New York: Plenum Publishing. Baker, E. L., & Herman, J. L. (in press). Technology and evaluation. In G. Haertel & B. Means (Eds.), *Approaches to evaluating the impact of educational technology*. New York: Teachers College Press.
7. Glossary:	*Summative evaluation:* The final evaluation that determines whether the program has succeeded in reaching its goals and whether it should be implemented.
8. User:	Assessment designer, program manager
9. ID:	Eva Baker, Zenaida Aguirre-Muñoz, Jia Wang, and David Niemi, *What Works in Distance Learning: Assessment Strategies,* Formative Evaluation Strategies, v.9, updated last on 02/21/03. See also O'Neil, H. F. (2003). *What works in distance learning* (Report to the Office of Naval Research). Los Angeles: University of Southern California, Rossier School of Education. Available at [URL to be added]

Summative Evaluation Strategies
(Baker, Aguirre-Muñoz, Wang, & Kazlauskas, v.9, 02/21/03)

1. Guideline (nontechnical):	Tests used for program evaluation should assist decision makers in their decisions on whether they should select, continue, modify, or drop a program.
2. Guideline (technical):	Test performance should be used in decisions judging the utility, appropriateness, implementation, and quality of the outcome of a program, usually in a comparative research design, contrasting performance of trainees under different training experiences, and evaluating them using common measures. Evaluate distance learning efforts using measures of implementation, outcomes, efficiencies, satisfaction, and long-term impact.
3. Guidelines based on:	Theory and research
4. Degree of confidence:	High
5. Comments:	The issue of the effect of learning via distance using technology is still contested, with one of the problems being that current research is not providing sufficiently robust data. A majority of distance education articles are opinion pieces and how-to-do-it articles. Mixed results of actual research may be explained by the fact that the research is based on individual case studies, qualitative data, or self-report studies. Many studies in distance learning indicate that teaching and learning at a distance is as effective as traditional classroom instruction and results in high satisfaction when compared to traditional approaches. There is the call to incorporate evaluation models, such as Kirkpatrick's (1994) four-level approach. After deciding the purposes or goals of the evaluation, the decision makers should narrow the assessment search, define the target population, the program participants, what should be evaluated, and the population to which the results are to be generalized. Cost and credibility of adopting an existing test meeting program purposes or goals should be compared with the cost of designing, administering, and reporting a new test. Summative evaluation can be supplemented with formative evaluation.
6. References:	American Educational Research Association, American Psychological Association, & National Council on Measurement in Education. (1999). *Standards for educational and psychological testing*. Washington, DC: American Educational Research Association.

Berge, Z. L., & Mrozowski, S. (2001). Review of research in distance education, 1990-1999. *American Journal of Distance Education, 13*(3), 5-19.

Herman, J. (Ed.). (1987). *CSE program evaluation kit* (2nd ed.). Newbury Park, CA: Sage.

Kirkpatrick, D. L. (1994). *Evaluating training programs: The four levels*. San Francisco: Berrett-Koehler.

Wisher, R. A., Champagne, J. L., Pawluk, J. L., Eaton, A., Thornton, D. M., & Curnow, C. K. (1999). *Training through distance learning: An assessment of research findings* (Tech. Rep. 1095). Alexandria, VA: United States Army Research Institute.

7. Glossary:

Kirkpatrick's four levels: A four-level model consisting of (1) reaction, (2) learning, (3) transfer, and (4) results. According to this model, evaluation should always begin with level one and then, as time and budget allow, should move sequentially through levels two, three, and four. *Encyclopedia of educational technology*. Retrieved July 26, 2002, from http://ccoe.sdsu.edu/eet

Test: "An evaluative device or procedure in which a sample of an examinee's behavior in a specified domain is obtained and subsequently evaluated and scored using a standardized process" (American Educational Research Association, American Psychological Association, & National Council on Measurement in Education, 1999, p. 183).

Formative evaluation: Begins and ends in the developmental stage of the program evaluation. It improves the program by providing information on implementation and progress.

Summative evaluation: Evaluation designed to present conclusions about the merit or worth of an object and recommendations about whether it should be retained, altered, or eliminated (see *Glossary of evaluation terms*, Evaluation Center, Michigan State University: Retrieved July 26, 2002, from http://ec-wmich.edu/glossary).

8. User: Program manager

9. ID: Eva Baker, Zenaida Aguirre-Muñoz, Jia Wang, and Edward Kazlauskas, *What Works in Distance Learning: Assessment Strategies,* Summative Evaluation Strategies, v.9, updated last on 02/21/03. See also O'Neil, H. F. (2003). *What works in distance learning* (Report to the Office of Naval Research). Los Angeles: University of Southern California, Rossier School of Education. Available at [URL to be added]

CHAPTER 6

WHAT WORKS IN DISTANCE LEARNING: MANAGEMENT STRATEGIES

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The following guidelines are presented in this chapter.

1. Strategies Based on Policy Framework and Administrative Structure
2. Strategies Based on Technical Support Environment
3. Strategies Based on Quality Assurance
4. Strategies Based on Library and Information Systems and Services
5. Strategies Based on Content Management System
6. Strategies Based on Student Support Services
7. Strategies Based on Instructor Competency
8. Strategies Based on Learner Characteristics
9. Strategies Based on Instructional Design

Strategies Based on Policy Framework and Administrative Structure
(Kazlauskas, v.5, 02/03/03)

1. Guideline (nontechnical):	A policy framework, administrative structure, and appropriate procedures and interventions should be developed to support distance learning efforts.
2. Guideline (technical):	To overcome the barriers to distance learning, provide a shared vision for distance learning, develop a strategic plan, activate an organizational structure that supports distance learning, and implement appropriate policies and procedures.
3. Guideline based on:	Expert opinion
4. Degree of confidence:	Medium
5. Comment:	Considerable effort has been placed on identifying the barriers to successful distance training and education. For example, Muilenburg and Berge (2001) identified barriers to distance education such as: technical expertise, support and infrastructure; evaluation and effectiveness; and faculty compensation and time. Many of the constructs identified by these researchers relate to a management perspective, that is, need for an adequate administrative structure and for organizational change. There is the need for management that supports distance learning efforts with commitment, a supportive organizational structure, and appropriate policy development. From another perspective, Prestera and Moller (2001) applied human performance technology, to organizational alignment for distance learning efforts, with attention to developing the goals, structure, and management practices associated with distance education programs.
6. References:	Bunn, M. D. (2001). Timeless and timely issues in distance education planning. *The American Journal of Distance Education, 13*(1), 55-67. Cho, S. K., & Berge, Z. L. (2002). Overcoming barriers to distance training and education. *United States Distance Learning Association Journal, 16*(1). Retrieved July 11, 2002, from http://www.usdla.org/html/journal/JAN02_Issue/article01.html Muilenburg L. Y., & Berge, Z. L (2001). Barriers to distance education: A factor analytic study. *The American Journal of Distance Education, 13*(2), 7-22.

Prestera, G. E., & Moller, L. A. (2001). Organizational alignment supporting distance education in post-secondary institutions. *Online Journal of Distance Learning Administration, 4*(4). Retrieved July 18, 2002, from http://www.westga.edu/~distance/ojdla/winter44/prestera44.html

7. Glossary:

Content analysis: The process of identifying and listing—in accordance with a narrowly defined classification system—categories of expression contained in a variety of information sources.
The Joint Committee on Standards for Educational Evaluation. (1994). *Program evaluation standards* (2nd ed.). Thousand Oaks, CA: Sage. Also available: *Glossary of Evaluation Terms,* Evaluation Center, Michigan State University, retrieved July 18, 2002, from http://ec.wmich.edu/glossary

Factor analysis: Clustering the variables most highly correlated with each other into homogeneous groups called "factors" and making inferences of the constructs measured by the factors from the size of the variables' correlations with them.
Krathwohl, D. R. (1997). *Methods of educational and social science research*: *An integrated approach* (2nd ed.). New York: Longman.

Human performance technology: A set of methods and procedures, and a strategy for solving problems, for realizing opportunities related to the performance of people. Human performance technology can be applied to individuals, small groups, and large organizations. It is, in reality, a systematic combination of three fundamental processes: performance analysis, cause analysis, and intervention selection.
International Society for Performance Improvement (ISPI). Retrieved July 18, 2002, from http://www.ispi.org/services/whatshtp.htm

8. User: Program manager

9. ID: Edward Kazlauskas, *What Works in Distance Learning: Management Strategies,* Strategies Based on Policy Framework and Administrative Structure, v.5, updated last on 02/03/03. See also O'Neil, H. F. (2003). *What works in distance learning* (Report to the Office of Naval Research). Los Angeles: University of Southern California, Rossier School of Education. Available at [URL to be added]

Strategies Based on Technical Support Environment
(Kazlauskas, v.5, 02/03/03)

1. Guideline (nontechnical):	Provide an appropriate technical support environment for distance learning.
2. Guideline (technical):	Provide the technical framework, hardware and software, and technical support for the distance learning constituency (e.g., designers, trainers, and learners).
3. Guideline based on:	Expert opinion
4. Degree of confidence:	Medium
5. Comment:	Common among successful organizations is an e-learning strategy that focuses on infrastructure with components therein focusing on technical architecture, standards for integrating existing and future online learning elements, and matching content to delivery whether that be Web-based training (WBT), interactive TV, or other technologies (McGraw, 2001). Reports from a variety of organizational contexts document the need to build quality distance learning programs, with technology a component of various general-purpose distance learning checklists that indicate the various factors that should be considered (Western Interstate Commission for Higher Education, 2001). Some specific examples of components include integrity and validity of information; interactivity; information presentation, learning space activity, system reliability, security, system support; and upgrades/improvements. A major aspect of developing the technical support environment is the conscious effort of selecting a learning management system. Using the results from survey research of 112 suppliers of learning management systems, Hall (2000) presented a bottom-line list of elements to be considered, including functionality, ease of use, integration and standards compliance.
6. References:	Hall, B. (2000). LMS 2001. *Learning Circuits ASTD*. American Society for Training and Development. Retrieved July 20, 2002, from http://www.learningcircuits.org/2001/jan2001/half.html See also 21-page executive summary of a full, extensive report as: Hall, B. (2002) *Learning management systems 2002*. Brandon-Hall. Retrieved July 20, 2002, from http://www.brandon-hall.com/public/execsums/execsum_LMS2002

McGraw, K. L. (2001). E-learning strategy equals infrastructure. *Learning Circuits*. American Society for Training and Development. Retrieved July 20, 2002, from http://www.learningcircuits.org/2001/jube2001/mcgraw.html

Western Interstate Commission for Higher Education—WICHE. (2001). *Best-practices for electronically offered degree and certificate programs*. Retrieved July 20, 2002 from http://www.wiche.edu/telecom/Accrediting-BestPractices.pdf

7. Glossary:

WBT: Web-based training; delivery of educational content via a Web browser. WBT often provides links to other learning resources and discussion groups and may include a facilitator who can provide course guidelines, manage discussion boards, and deliver lectures.
American Society for Training and Development. *Learning Circuits*. E-Learning Glossary. Retrieved July 20, 2002, from http://www.learningcircuits.org/glossary.html

8. User: Program manager

9. ID: Edward Kazlauskas, *What Works in Distance Learning: Management Strategies,* Strategies Based on Technical Support Environment, v.5, updated last on 02/03/03. See also O'Neil, H. F. (2003). *What works in distance learning* (Report to the Office of Naval Research). Los Angeles: University of Southern California, Rossier School of Education. Available at [URL to be added]

Strategies Based on Quality Assurance
(Kazlauskas, v.5, 02/03/03)

1. Guideline (nontechnical):	In order to assure quality, establish standards for distance learning programs.
2. Guideline (technical):	Quality assurance for a distance education service is provided through the specification of standards, in such areas as organizational support, course development, teaching/learning, course structure, student support, instructor support, and evaluation/assessment, and through steps taken to assure that the standards are met.
3. Guideline based on:	Expert opinion
4. Degree of confidence:	Medium
5. Comment:	In a report on benchmarks for success in Internet-based distance education (Phipps & Merisoitis, 2000), six institutions were examined that are leaders in distance education to ascertain their level of compliance with quality standards identified and published by various entities. The report outlines 24 benchmarks considered to be essential for quality distance education programs, covering the areas of organizational support, course development, the teaching/learning process, course structure, student support, instructor support, and evaluation/assessment. Quality assurance has more of a business orientation when compared to the traditional education model. Pond (2002) discussed the paradigm shift associated with this approach, with, for example, a change from institutional- to learner-focused benchmarks for success, and from a process-based to a product/outcome-based model. Included in distance education quality assurance is, in implementing general ISO 9001:2000 *Standards for Quality Management Systems*, a quality assurance model with 20 sets of system requirements, many of which are technology-related, that can act as a guide and assist in Quality Assurance Certification (Benjamin Franklin Institute of Global Education, 2001).
6. References:	Benjamin Franklin Institute of Global Education. (2001). *Distance education—Quality Assurance Institute*. Retrieved July 20, 2002, from http//www.academyweb.com/depaintro.htm

Phipps, R., & Merisoitis, J. (2000). *Quality on the line: Benchmarks for success in Internet-based distance education.* Washington DC: Institute for Higher Education Policy.

Pond, W. K. (2002). Distributed education in the 21st century: Implications for quality assurance. *Online Journal of Distance Learning Administration*, *5*(2). Retrieved July 20, 2002, from http://www.westga.edu/~distance/ojdla/summer52/pond52.html

7. Glossary:

Benchmark: A standard used to compare performance of a program, application, system; a fixed point of reference. Adapted from: *Chambers science and technology dictionary*. (1988). New York: W. & R. Chambers.

ISO 9001: International Organization for Standardization, an international federation of national standards bodies. Standard relating to quality assurance.
American Society for Training and Development. *Learning Circuits*. E-Learning Glossary. Retrieved July 20, 2002, from http://www.learningcircuits.org/glossary.html

8. User: Program manager

9. ID: Edward Kazlauskas, *What Works in Distance Learning: Management Strategies,* Strategies Based on Quality Assurance, v.5, updated last on 02/03/03. See also O'Neil, H. F. (2003). *What works in distance learning* (Report to the Office of Naval Research). Los Angeles: University of Southern California, Rossier School of Education. Available at [URL to be added]

Strategies Based on Library and Information Systems and Services
(Kazlauskas, v.5, 02/03/03)

1. Guideline (nontechnical): For a distance learning program to succeed there must be appropriate library and information systems and services.

2. Guideline (technical): Integrate library and information services and systems into learners' distance learning experiences.

3. Guideline based on: Expert opinion

4. Degree of confidence: Medium

5. Comment: Traditionally the library has been the vehicle that has supported student learning through access to resources, assistance in search for such resources, and retrieval of materials. Recently, the library has transformed itself into a digital repository with additional resources, including full text, made available over the World Wide Web. It is incumbent on distance learning management to provide for such access and use, either through existing library services or through contract with library-service providers. Library-related organizations, such as the American Library Association, have developed guidelines for distance learning library services (Association of College and Research Libraries, 2000). Most distance learning evaluation guidelines, such as that from the Western Interstate Commission for Higher Education (2001), include library/information resources as a criterion.

   In a report for a major bibliographic utility, McLean (2002) noted the need for interoperability/interaction of traditional library systems with the new concept of "learning space." Included in this concept is the interplay of internal document and content management systems, online search and retrieval systems, external resources, and portals.

6. References:

Association of College and Research Libraries. (2000). *Guidelines for distance learning library services*. American Library Association. Retrieved July 20, 2002, from http://www.ala.org/acrl/guides/distlrng.html

McLean, N. (2002). *Libraries and e-learning: Organizational and technical interoperability*. Dublin, OH: OCLC. Retrieved July 20, 2002, from http://www.oclc.org/research/publications/archive/mclean_neil_2002000308_rev.doc

Western Interstate Commission for Higher Education—WICHE. (2001). *Best-practices for electronically offered degree and certificate programs*. Retrieved July 20, 2002, from http://www.wiche.edu/telecom/Accrediting-BestPractices.pdf

7. Glossary:

Content management system—or *Learning content management system (LCMS):* A software application that allows trainers and training directors to manage both the administrative and content-related functions of training. A LCMS combines the course management capabilities of a LMS (learning management system) with the content creation and storage capabilities of a CMS (content management system). Includes learning objects, the reusable, media-independent chunks of information used as modular building blocks for e-learning content.
American Society for Training and Development. *Learning Circuits*. E-Learning Glossary. Retrieved July 20, 2002, from http://www.learningcircuits.org/glossary.html

Learning space: An imaginary geography in which the learning enterprise flourishes. American Society for Training and Development.
Learning Circuits. E-Learning Glossary. Retrieved July 20, 2002, from http://www.learningcircuits.org/glossary.html

Portal: A Web site that acts as a "doorway" to the Internet, or a portion of the Internet, targeted towards one particular subject; offers learners or organizations consolidated access to learning and training recourses from multiple sources. American Society for Training and Development.
Learning Circuits. E-Learning Glossary. Retrieved July 20, 2002, from http://www.learningcircuits.org/glossary.html

8. User:

Program manager

9. ID:

Edward Kazlauskas, *What Works in Distance Learning: Management Strategies,* Strategies Based on Library and Information Systems and Services, v.5, updated last on 02/03/03. See also O'Neil, H. F. (2003). *What works in distance learning* (Report to the Office of Naval Research). Los Angeles: University of Southern California, Rossier School of Education. Available at [URL to be added]

Strategies Based on Content Management System
(Kazlauskas, v.5, 02/03/03)

1. Guideline (nontechnical):	Develop opportunities to exchange and reuse the content of distance learning.
2. Guideline (technical):	Monitor and be proactive regarding the developments in content management and in the reuse and interoperation among learning systems.
3. Guideline based on:	Expert opinion
4. Degree of confidence:	Medium
5. Comment:	To exploit the cost benefits and return on investment of distance learning, an approach is needed that will easily create, rapidly deploy, and manage content. A learning content management system (LCMS) provides for the management of the administrative functions of training and, importantly, for the management of the learning content in the form of small learning objects, in effect separating the content from the medium or presentation format. Instructional designers can reuse content developed by others and present this in multiple media formats. This perspective is presented by Chapman and Hall (2001), where it is suggested that a learning management content system is needed to identify, collect, organize, and present content to learners. Such a repository would create, store, reuse, and manage learning content, including more traditionally viewed libraries and information resources. Anido et al. (2002) discussed the developments in learning technology standardization with the purpose being the reuse and interoperation among learning systems. Educational metatdata provide a means to facilitate the location of learning resources, with the users then being able to find resources applicable to their own contexts. The Shared Content Object Reference Model (SCORM) provides a set of interrelated specifications supporting the interoperability, accessibility, and reusability of Web-based learning content. The effort, the results of which are distributed through the Advanced Distributed Learning (ADL) Initiative, is focused on meeting the Department of Defense's requirements for Web-based learning content.
6. References:	Advanced Distributed Learning (ADL). (2002). *SCORM overview*. Retrieved December 13, 2002, from http://www.adlnet.org

Anido, L. E., Fernandez, M. J., Caeiro, M., Santos, J. M., Rodriguez, J. S., & Llamas, M. (2002). Educational metadata and brokerage for learning resources. *Computers & Education, 38*, 351-374.

Chapman, B., & Hall, B. (2001) *Learning content management systems*. Sunnyvale, CA: Brandon-Hall.com. Retrieved July 18, 2002, from http://www.brandon-hall.com/learnconmansy.html

7. Glossary:

Interoperation/Interoperability: The ability of hardware or software components to work together effectively. American Society for Training and Development.
Learning Circuits. E-Learning Glossary. Retrieved July 20, 2002, from http://www.learningcircuits.org/glossary.html

Learning Content Management System (LCMS): A software application that allows trainers and training directors to manage both the administrative and content-related functions of training. A LCMS combines the course management capabilities of a LMS (learning management system) with the content creation and storage capabilities of a CMS (content management system). Includes learning objects, the reusable, media-independent chunks of information used as modular building blocks for e-learning content.
American Society for Training and Development. *Learning Circuits*. E-Learning Glossary. Retrieved July 20, 2002, from http://www.learningcircuits.org/glossary.html

Metadata: Information about content that allows it to be stored and retrieved from a database, Web site; learning objects are most effective when organized by a metadata classification system and stored in a data repository such as a LCMS.
American Society for Training and Development. *Learning Circuits*. E-Learning Glossary. Retrieved December 4, 2002, from http://www.learningcircuits.org/glossary.html

8. User: Program manager

9. ID: Edward Kazlauskas, *What Works in Distance Learning: Management Strategies,* Strategies Based on Content Management System, v.5, updated last on 02/03/03. See also O'Neil, H. F. (2003). *What works in distance learning* (Report to the Office of Naval Research). Los Angeles: University of Southern California, Rossier School of Education. Available at [URL to be added]

Strategies Based on Student Support Services
(Kazlauskas, v.5, 02/03/03)

1. Guideline (nontechnical): Distance learning participants need support services for success.

2. Guideline (technical): Provide an appropriate learner support environment with assistance in counseling, scheduling and registration, problem solving, mentoring, delivery of course materials, and maintenance of appropriate records and transcripts.

3. Guideline based on: Expert opinion

4. Degree of confidence: Medium

5. Comment: Student support services are central to the success of a distance learning program. These services include providing advisement, counseling, materials and textbook delivery, test materials delivery, and examination proctoring with service policies that should be of the same standard as those in nondistance modes (Gellman-Danley & Fetzner, 1998). From the perspective of post-distance learning course completion, support services relates to the maintenance of records and delivery of verification for courses and training, such as the forwarding of course transcripts.

The eArmyU, officially named the Army University Access Online (AUAO), provides for counseling, online course selection, virtual mentoring, delivery of a "tech pack" of hardware and software, tutorials, and career guidance (Lorenzo, 2002). Wagner (2001) further expanded this discussion and presented a description of the types of services to be provided in a virtual student support system, including an explanation of requirements, accurate record keeping, FAQs, study skills information, policies, how to get computer access and technical support, and an online bookstore. One-to-one advisement can be supported through e-mail, chat rooms, and listserv approaches. See also guidelines on Learning Strategies.

6. References:

Gellman-Danley, B., & Fetzner, M. J. (1998). Asking the really tough questions: Policy issues for distance education. *Online Journal of Distance Learning Administration, 1*(1). Retrieved July 20, 2002, from http://www.westga.edu/~distance/danley11/html

Lorenzo, G. (2002, May/June). *eArmyU and the future of distance education*. Corporate University. Retrieved July 21, 2002, from http://ts.mivu.org/deafult.asp?show=article&id=998

	Wagner, L. (2001). Virtual advising: delivery student services. *Online Journal of Distance Learning Administration, 4*(3). Retrieved July 21, 2002, from http://www.westga.edu/~distance/ojdla/fall43/wagner43.html
7. Glossary:	*FAQs:* Frequently asked questions; a file established for public discussion groups containing questions and answers new users often ask. American Society for Training and Development. *Learning Circuits*. E-Learning Glossary. Retrieved July 20, 2002, from http://www.learningcircuits.org/glossary.html
8. User:	Program manager
9. ID:	Edward Kazlauskas, *What Works in Distance Learning: Management Strategies,* Strategies Based on Student Support Services, v.5, updated last on 02/03/03. See also O'Neil, H. F. (2003). *What works in distance learning* (Report to the Office of Naval Research). Los Angeles: University of Southern California, Rossier School of Education. Available at [URL to be added]

Strategies Based on Instructor Competency
(Kazlauskas, v.5, 02/03/03)

1. Guideline (nontechnical):	Instructors must have the necessary skills and competencies appropriate for teaching via distance learning.
2. Guideline (technical):	Develop competencies in instructors through training, and mentoring and modeling, in distance learning concepts, design approaches, technologies, delivery modes, communication approaches, testing methods, implementation strategies, evaluation, and operation.
3. Guideline based on:	Expert opinion
4. Degree of confidence:	Medium
5. Comment:	Instructors need assistance in the transition from traditional to online teaching. Rockwell, Schauer, Fritz, and Marz (2000) provided the results of a survey of the need for training, assistance, and support to develop distance learning. Respondents noted the need for assistance in developing instructional experiences that supported interactive learning experiences, developing and improving instructional materials, and applying selected technologies. Bonk (2002) also conducted *s*urvey research related to the use of e-learning in the corporate world and other training settings. He identified a number of approaches used for supporting the instructor. These included e-mail support, online help and tutorials, internal support from other staff, attendance at conferences workshops, and use of local experts for supporting design and development efforts. He emphasized the need for organizational support in terms of training for designers, and the need for their certification. Clay (1999) provided an overview of the components of an effective development and support program for distance education instructors. Types of effective training are noted, such as group sessions, one-on-one lab sessions, mentorships, observation, and scheduled discussion sessions among peers. Typical distance learning training topics are listed, with some additional topics that are sometimes overlooked—that is, the need for backup and contingency plans, and the need to address copyright issues.
6. References:	Bonk, C. J. (2002). *Online training in an online world.* Bloomington, IN: CourseShare.com. Retrieved July 26, 2002, from http://www.jonesknowledge.com/corporate/index.php

Clay, M. (1999). Development of training and support programs for distance education instructors. *Online Journal of Distance Learning Administration, 2*(3). Retrieved July 26, 2002, from http://www.westga.edu~distance/clay23.html

Crumpacker, N. (2001). Faculty pedagogical approach, skill, and motivation in today's distance education milieu. *Online Journal of Distance Learning Administration, 4*(4). Retrieved July 26, 2002, from http://www.westga.edu/~distance/ojdla/winter44/crumpacker44.html

O'Neil, H. F., Jr., & Herl, H. E. (1998, April). *Reliability and validity of a trait measure of self-regulation*. Presented at the annual meeting of the American Educational Research Association, San Diego, CA.

Rockwell, K., Schauer, J., Fritz, S. M., & Marz, D. B. (2000). Faculty education, assistance and support needed to deliver education via distance. *Online Journal of Distance Learning Administration, 3*(2). Retrieved July 26, 2002, from http://www.westga.edu/~distance/rockwell32.html

7. Glossary:

Effort: The extent to which one works hard on a task (O'Neil & Herl, 1998). Effort, as manifested in self-regulation, can be described as a continued and sustained exertion of mental power to achieve some worthy and difficult end. Persistence, sometimes used synonymously with effort, is to continue steadily or firmly in some state, purpose, or course of action, often in the face of distractions.

Modeling: Presenting a desired behavior or process so that it can be imitated by the learner. Modeling provides an example of the required performance whereby the most important steps and decisions are stressed. The goal is imitation of the performance of an expert by the learner.
Glossary of Instructional Strategies. Retrieved December 10, 2002, http://glossary.plasmalink.com/glossary.html

8. User: Program manager

9. ID: Edward Kazlauskas, *What Works in Distance Learning: Management Strategies,* Strategies Based on Instructor Competency, v.5, updated last on 02/03/03. See also O'Neil, H. F. (2003). *What works in distance learning* (Report to the Office of Naval Research). Los Angeles: University of Southern California, Rossier School of Education. Available at [URL to be added]

Strategies Based on Learner Characteristics
(Kazlauskas, v.5, 02/03/03)

1. Guideline (nontechnical): Design distance learning taking into consideration learner characteristics.

2. Guideline (technical): In distance learning, assess learners' prior knowledge, experience with distance learning, opinions and attitudes, preferences, motivation level, anxiety, and self-regulation skills.

3. Guideline based on: Research

4. Degree of confidence: High

5. Comment: Distance learning is a form of self-directed or self-regulated learning, and as such, students need to manage, control and evaluate their learning behavior. Learners require motivation, appropriate learning strategies, and time management skills. The opinions of learners toward distance learning can be an important factor in success (Valenta, Therriault, Dieter, & Mrtek, 2001).

Along the same line of research, Christensen, Anakwe, and Kessler (2001) posited the effect of technology perception on students' receptivity toward distance learning. Providing distance learning per se is not perceived as viable unless it is coupled with its perceived usefulness to learning. It should be noted that receptivity towards distance learning is enhanced by interactivity that provides increased support, guidance, feedback, and small-group learning. Lim (2001) indicated that computer-self-efficacy was a predictive variable, and a positive relation existed between satisfaction and future distance learning enrollment intent.

6. References:

Christensen, E. W., Anakwe, U. P., & Kessler, E. H. (2001). Receptivity to distance learning: The effect of technology, reputation, constraints, and learning preferences. *Journal of Research on Computing in Education, 33*, 263-279.

Lim, C. K. (2001). Computer self-efficacy, academic self-concept, and other predictors of satisfaction and future participation of adult distance learners. *The American Journal of Distance Education, 13*(2), 41-51.

Valenta, A., Therriault, D., Dieter, M., & Mrtek, R. (2001). Identifying student attitudes and learning styles in distance education. *Journal of Asynchronous Learning Networks, 5*(2). Retrieved July 26, 2002, from

	http://www.aln.org/alnweb/journal/Vol5_issue2/Valenta/Valenta.html
7. Glossary:	*Preference:* A self-report of choice rather than a measure by tasks to differentiate abilities. Smith, P. L., & Ragan, T. J. (1999). *Instructional design* (2nd ed.). Upper Saddle River, NJ: Merrill. *Self-efficacy:* Self-judgment of one's ability to master a task. One's confidence in being able to accomplish a particular task. Bandura, A. (1977). Self-efficacy: Toward a unifying theory of behavioral change. *Psychological Review 84*, 191-215.
8. User:	Instructional designer
9. ID:	Edward Kazlauskas, *What Works in Distance Learning: Management Strategies,* Strategies Based on Learner Characteristics, v.5, updated last on 02/03/03. See also O'Neil, H. F. (2003). *What works in distance learning* (Report to the Office of Naval Research). Los Angeles: University of Southern California, Rossier School of Education. Available at [URL to be added]

Strategies Based on Instructional Design
(Kazlauskas, v.5, 02/03/03)

1. Guideline (nontechnical):	Learning is enhanced in a distance context by the incorporation of effective instructional features into the design.
2. Guideline (technical):	Incorporate effective learning features into distance learning instructional design, examples of which include interactivity, timely feedback, and use of small learning groups.
3. Guideline based on:	Research
4. Degree of confidence:	High
5. Comment:	A criticism of distance learning has been in the variability of the overall quality of online courses. This variation in quality is due to the lack of adequate, timely, and consistent feedback, the lack of interactivity, and the lack of a virtual community. Thus, much of the literature reflects the need to employ timely feedback, to use active learning to promote learner engagement, and to develop virtual learning communities. Picciano (2002) noted that the literature is extensive on the topic of interactivity and concluded that instructor responsiveness and feedback, instructor-to-learner interaction, and learner-to-learner interaction are keys to success. Robyler and Ekhaml (2000) developed a rubric for determining the level of interactivity in a distance learning course. Haythornthwaite, Kazmer, Robins, and Shoemaker (2000) conducted a detailed analysis of a distance program in terms of the development of a virtual community and how learners define and maintain this community. The researchers provided recommendations to support virtual communities, namely developing initial bonding through an intensive proximity-based "live" class session, monitoring and supporting interaction and participation such as through examining chat room sessions, and providing multiple technology-based communication means for interaction.
6. References:	Haythornthwaite, C., Kazmer, M. M., Robins, J., & Shoemaker, S. (2000). Community development among distance learners: Temporal and technological dimensions. *Journal of Computer Media Communications, 6*(1). Retrieved August 11, 2002, from http://www.ascusc.org/jcmc/vol6/issue1/haythornthwaite.html

Picciano, A. G. (2002). Beyond student perceptions: Issues of interaction, presence, and performance in an online course. *Journal of Asynchronous Learning Networks, 6*(1). Retrieved August 8, 2002, from http://www.aln.org/alnweb/journal/Vol6_issue1/6_1picciano.htm

Rafaeli, S., & Sudweeks, F. (1997). Networked interactivity. *Journal of Computer Media Communications, 2*(4). Retrieved August 11, 2002, from http://www.ascusc.org/jcmc/vol2/issue4/rafaeli_sudweeks.html

Robyler, M. D., & Ekhaml, L. (2000). How interactive are your distance courses? A rubric for assessing interactivity in distance courses. *Online Journal of Distance Learning Administration, 3*(2). Retrieved November 11, 2002, from http://www.westga.edu/~distance/robyler32.html

7. Glossary:

Active learning: Any approach that engages learners by matching instruction to the learner's interests, understanding and development level. Often includes hands-on and authentic activities. *Glossary of Instructional Strategies*. Retrieved December 13, 2002, from http://glossary.plasmalink.com/glossary.html

Interaction: Refers to communication, participation, and feedback between learners with other learners and/or instructors/tutors. Yacci, M. *Interactivity demystified: a structural definition for distance education and intelligent CBT*. Retrieved November 11, 2002, from http://www.it.rit.edu/~may/inte.pdf

Virtual community: Also known as an online community; a meeting place for people on the Internet. Designed to facilitate interaction and collaboration among people who share common interests and needs. Online communities can be open to all or by membership only and may or may not offer moderator tools. American Society for Training and Development. *Learning Circuits*. E-Learning Glossary. Retrieved August 11, 2002, from http://www.learningcircuits.org/glossary.html

8. User: Instructional designer

9. ID: Edward Kazlauskas, *What Works in Distance Learning: Management Strategies,* Strategies Based on Instructional Design, v.5, updated last on 02/03/03. See also O'Neil, H. F. (2003). *What works in distance learning* (Report to the Office of Naval Research). Los Angeles: University of Southern California, Rossier School of Education. Available at [URL to be added]

CHAPTER 7

IMPLEMENTATION ISSUES AND NEXT STEPS

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The suggested steps in the implementation process for the guidelines are shown in Table 2. The process begins with a series of briefs to the "customers" and is completed with a formative evaluation.

Table 2

Guidelines Implementation Process

Visit Navy Education and Training Command (NETC) to brief results and select test sites.
Specify how to scale up (e.g., copyright permission for reproduction, knowledge management lessons learned—see, e.g., Davenport & Glaser, 2002; Hansen, Nohria, & Tierney, 1999).
Scale up procedures for use (e.g., "books" are paper-based at site and searchable database with 2-page guidelines is at NETC portal).
Set up guidelines update procedures (e.g., every 2 years).
Set up reach-back procedures (e.g., availability of experts).
Set up and conduct formative evaluation.

Our planned approach to formative evaluation of the guidelines is depicted in Table 3. The procedure involves multiple steps, some of them iterative. We would begin the formative evaluation process by checking whether the NETC design of portal use is congruent with NETC specifications and end with implementing cycles of revisions, followed by new data collection in

activities 4 through 8. During a project, we would modify the details of approach as needed to provide useful and timely information to NETC.

Table 3

Formative Evaluation Activity

1. Check the system design, including portal use, against its specifications.
2. Check the design of assessments for outcome and diagnostic measures against specifications. Design and try out measures.
3. Check the validity of instructional strategies embedded in the NETC system (e.g., navigational strategies) against research literature.
4. Conduct feasibility review with the users.
    - Are right tasks being trained?
        - Review to be conducted with users
5. Conduct feasibility tests with the users.
    - One-on-one testing
    - Small-group testing
6. Assess effectiveness.
    - Cognitive
        - e.g., does it improve domain knowledge (e.g., instructional strategy knowledge?
    - Affective
        - e.g., does it improve self-efficacy?
7. Do experts and novices differ in performance?
8. Does more training lead to better performance?
9. Implement revisions.

Our next steps for our research program in this area are shown in Table 4. Initially the focus will be on guidelines to facilitate individual learning (e.g., self-regulation and motivation).

Then retrospective cases for each set of Year 1 guidelines will be designed and developed. At the end of the second year of effort, we will generate a final report and explore publishing the guidelines in the open literature. Subsequent work could involve guidelines to facilitate team and organizational learning as well as gaming and simulation.

Table 4

Next Steps: March 2003 Through February 2004

Create draft Self-Regulation Guidelines (Summer 03)
Create draft Motivation Guidelines (Summer 03)
Create Retrospective Cases for each set of guidelines (see Appendix, Table A1) (Summer 03)
Create cases (e.g., examples of learning from examples or problem-based learning) (Fall 03)
Edit final Self-Regulation and Motivation Guidelines (Fall 04)
Write final report
Explore book publication organizations (e.g., American Society for Training and Development [ASTD]; International Society for Performance Improvement [ISPI])

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APPENDIX

Table A1

Retrospective Case Specification (Version 1)

Definition	:	A case is a description of a realistic problem scenario that is relevant to a particular profession or field of study (e.g., a case may be a DL lesson showing various instructors trying to teach a lesson on a particular topic).
	:	*Retrospective case-based learning,* a learner looks back over the history of a problem and attempts to resolve it . . . with advice and commentary on decisions and choices that were made . . .
	:	*Interactive case-based learning,* a learner attempts to solve a problem and receives realistic feedback and commentary. Interactive case-based learning can take the form of computer-based simulations of realistic problems.
Common topic	:	e.g., car brakes, a surgery procedure, C4ISR, electronics, acquisition procedures

Note. Source: Mayer, R. E. (2003). *Learning and instruction* (pp. 319-321). Upper Saddle River, NJ : Pearson Education, Inc.